

*Archives of*  
**PHYSICAL MEDICINE**  
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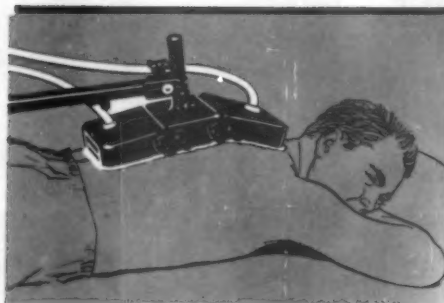
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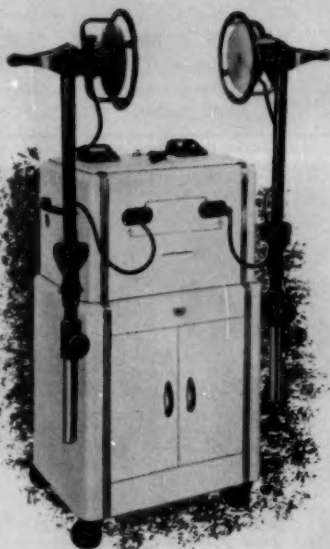
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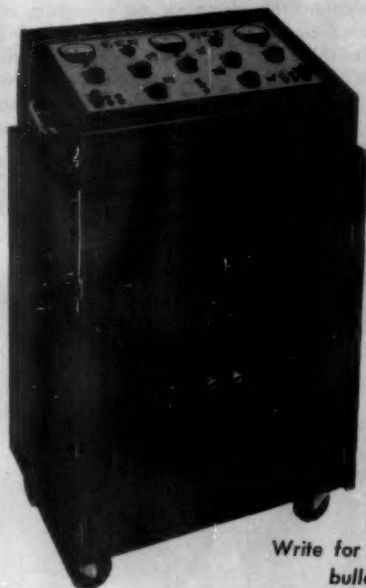
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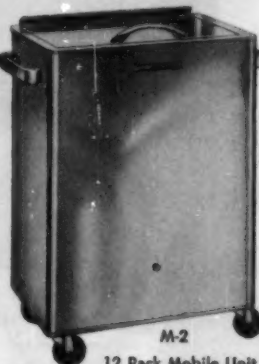
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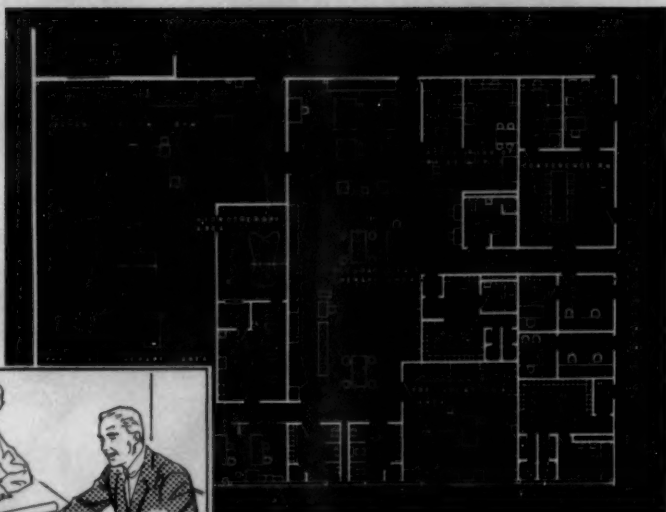


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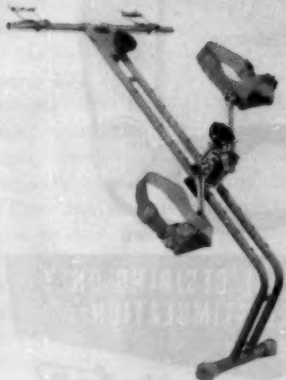
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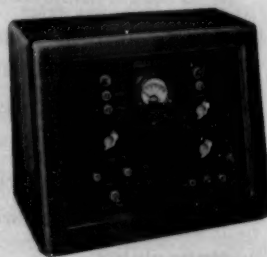
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# Paraffin Bath as Thermo-therapy: An Evaluation

Cyrus W. Stimson, M.D.  
Gertrude B. Rose, A.B., R.P.T.  
and  
Paul A. Nelson, M.D.  
Cleveland

● The paraffin bath is an effective means of applying heat to the hands, wrists and elbows and to the feet and ankles. It is a valuable adjunct in local treatment of involved parts for such conditions as rheumatoid arthritis, osteoarthritis, tenosynovitis, and reflex sympathetic dystrophy. Contraindications for its use are impaired arterial or venous circulation, dermatitis, open wounds or heat sensitivity. The effectiveness of paraffin bath, whirlpool bath, and contrast bath in heating of an extremity is compared. A disadvantage in the past has been the difficulty in utilizing the paraffin bath for home treatment. A safe and practical way of arranging such therapy in the home is described.

The most effective method for the therapeutic application of heat to the hand or foot is its immersion in a heated liquid medium. Only in this way can heat be transmitted simultaneously to the flexor and extensor surfaces and to the interdigital areas.

Melted paraffin wax at temperatures from 125 to 129 F. and hot water at temperatures from 100 to 110 F. are the most satisfactory media for immersion since they are readily available, inexpensive, and nonirritating to the skin. There are several methods for immersion in each medium: in paraffin, there are the continuous immersion, dip-immersion, and dip-wrap techniques; in hot water, there are the hand bath, whirlpool bath, and contrast bath. All of these methods are simple and convenient for use in a department of physical therapy and, with the possible exception of the whirlpool bath, are easily adapted for use by the patient in the home.

There have been few objective studies reported in the literature, comparing the effectiveness in heating of the paraffin bath with that of other forms of immersion. Some clinicians have discounted the value of the paraffin bath and considered it impractical for home use. In view of these facts, the present study was undertaken.

The purpose of this paper is to evaluate the paraffin bath as a form of thermo-therapy, on the basis of a comparison of the increases in skin temperature produced by the above-mentioned methods for immersion in melted paraffin and in hot water. A brief review of

the medical literature concerning the paraffin bath, a summary of the physiologic effects of this treatment, and a description of two innovations in technic also are presented. These innovations are (1) an improved method of utilizing the paraffin bath in home treatment, and (2) a method of preventing paraffin from developing a disagreeable odor after frequent use.

## Review of Literature

A French physician, de Sandfort,<sup>1</sup> is credited with the first report concerning treatment with paraffin bath. The technic received considerable attention in the reconstruction hospitals of the Royal Army Corps in England during World War I. In 1920, Humphris<sup>2</sup> stated that the paraffin bath was useful in the treatment of contractures, frostbite, chilblains, neuritis, fibrositis, rheumatic and gouty joints, and leg cramps. He recommended that the temperature of the melted paraffin be between 125 and 130 F., that the duration of treatment be 20 minutes, and that the bath be followed by massage. Humphris observed that after termination of paraffin bath, hyperemia of the treated part persisted for some time and moisture continued to appear on the skin for an hour or more.

Dickson, who observed the effectiveness of the paraffin bath in England in 1917, introduced this form of thermo-therapy to the Cleveland Clinic in 1922. Dissatisfied with the hazards of the old gas-heated bath, he helped design an improved electrically heated model which was described in an article by Portmann<sup>3</sup> in 1926. In 1934, Dickson<sup>4</sup> described his experiences with the paraffin bath and enthusiastically recommended its use.

Read at the Thirty-fifth Annual Session of the American Congress of Physical Medicine and Rehabilitation, Los Angeles, September 10, 1957.

From the Department of Physical Medicine and Rehabilitation, The Cleveland Clinic Foundation, and The Frank E. Bunts Educational Institute.

Several studies have been reported on the influence of the paraffin bath on body temperatures. Hill,<sup>5</sup> in 1935, observed rises in oral temperature of from 1 to 3 degrees following immersion of hand, elbow, or knee in paraffin. Using a copper constantan thermocouple, Zeiter,<sup>6</sup> in 1938, studied skin temperatures produced by various paraffin technics. The temperature of the paraffin bath ranged from 130.0 to 136.4 F. In one series the hand was dipped slowly in the paraffin, until three to five layers of paraffin had congealed on the hand, and then immersed in the bath; for this group, the skin temperature during immersion stabilized at 116.0 F. In another series, after three to five layers of paraffin had formed on the hand, it was removed from the bath and wrapped in towels; at one minute after wrapping, the skin temperature was 120.0 F.; at five minutes, 110.0 F.; and at ten minutes, 105.0 F. Zeiter concluded that continuous immersion in the paraffin bath was more effective than the dip-wrap method in obtaining maximal heating of the skin.

Sedwitz,<sup>7</sup> in 1939, studied the effects of the paraffin bath on skin temperature and blood flow in patients with peripheral vascular disease. He found that application of a paraffin coating to an uninvolved extremity produced in the involved extremity a reflex rise in skin temperature of from 2 to 3 degrees and an increase in the oscillometric readings of from 1 to 3 units.

In 1955, Harris and Mallard<sup>8</sup> reported a mean rise in skin temperature of 10.4 degrees F. in six subjects immediately after the hands had been dipped in paraffin at temperatures of from 110 to 115 F. Afterwards, the hands, covered with a coating of paraffin, were wrapped in wax paper and towels for 20 minutes. Skin temperatures, which were recorded at ten-minute intervals for one hour after wrapping, rapidly fell to pretreatment levels or lower.

#### Physiologic Effects

Paraffin is a waxy substance, a purified mixture of solid hydrocarbons, that is

obtained from crude petroleum by fractional distillation. Its physical properties, such as tensile strength, melting point, specific heat, and heat conductivity, vary considerably depending upon the fraction from which it is refined. For household canning of jellies and preserves, a paraffin with a fairly high tensile strength is desirable; this substance, which is sold under the trademark name "Parawax," has a melting point of about 134.0 F. With such a high melting point, this paraffin is unsuited for therapeutic application, which requires a wax with a melting point in the range from 125.0 to 127.0 F.\*

Immersion of a hand or foot in liquid paraffin is a form of heating by conduction. Heat is transferred to the skin by the layer of paraffin in direct contact with it. Because of low specific heat, paraffin is not able to deliver as much heat per unit mass as, for example, can water at the same temperature. As the layer of paraffin loses its heat to the skin, its temperature is lowered beyond its melting point and it solidifies. In solidification, a considerable amount of additional heat is released (the heat of fusion), which is also transferred to the skin. Since solid paraffin is a poor thermal conductor, the immersed hand or foot is partially insulated from the hot liquid paraffin by a cooler, solidified, glovelike layer. Because of these physical properties, immersion of the distal part of an extremity can be tolerated in melted paraffin at temperatures much higher than those tolerated in water. Since liquid paraffin and water are immiscible, aqueous secretions from the skin do not dissolve in the paraffin but accumulate in the bottom of the bath.

The systemic effects of the paraffin bath are minimal. The local effects are the same as those of any other form of local heating. The temperature of the skin increases as long as more heat is delivered to the skin by the paraffin than can be carried away by the circulating blood. Heating of the superficial tissues causes relaxation of the smooth muscle

\*A paraffin meeting this specification is 125/127 AMP refined wax, a product of The Standard Oil Company, which can be purchased in 50-pound cartons at about 13½ cents per pound (1956).

fibers in arterioles, which results in dilatation of the peripheral blood vessels. The consequent hyperemia and increased rate of blood flow cause increases in transudation of tissue fluid, in lymph flow, and in absorption of exudate. Other local effects of the paraffin bath are relief of pain, release of skeletal muscle spasm, increase in perspiration, and acceleration of metabolism in tissue.

#### Material and Methods

Five normal adults, two men and three women, ranging in age from 22 to 36 years, volunteered for the study. The left or right hand, wrist, and distal forearm of each person was used for application of each of the six immersion technics: for paraffin (1) continuous immersion, (2) dip-immersion, and (3) dip-wrap; and for water (1) hand bath, (2) whirlpool bath, and (3) contrast bath.

The procedures were carried out in two rooms of about equal size under usual clinical conditions. The temperature of the room in which the paraffin bath was located ranged from 71.0 to 72.0 F.; however, in the hydrotherapy room, the temperature ranged from 71.0 to 75.0 F. because of heat given off from equipment.

Two thermistor units, specially designed for measuring surface temperatures, were placed on the dorsal aspect of the hand to be treated between the first and second metacarpals (fig. 1). The flat, sensitive surfaces of the units were faced in opposite directions, one toward and one away from the skin; the units were called, respectively, the *skin* and the *interface probes*. The active element in each probe is a thermally sensitive resistor, a mixture of metallic oxides, the electrical resistance of which decreases as its temperature rises. This element is embedded in plastic in a shallow stainless steel cup  $\frac{3}{8}$  inch in diameter and is connected in series to a meter calibrated to read temperatures directly in degrees Fahrenheit or Centigrade.\* To maintain the probes in their correct position during immersion of the hand, the skin of the hand where they

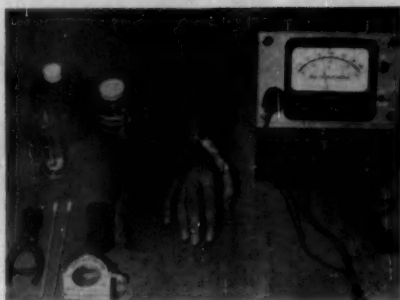


Fig. 1—Placement of skin and interface thermistor probes, materials utilized, and apparatus for measurement of temperatures.

were to rest was painted with tincture of benzoin and the probes were attached to the hand with plastic tape. Two holes were punched in the plastic tape to expose the probes to the medium.

\*The apparatus used in this study for recording temperatures was the YSIC Tele-Thermometer Model 44 (range from 60.0 to 212.0 F.) with No. 9 surface temperature probes, manufactured by Yellow Springs Instrument Co., Inc., Yellow Springs, Ohio.

After application of the probes to the hand, temperatures were recorded at 5-minute intervals until the readings became approximately stable, which usually required 10 minutes. The hand, wrist, and distal forearm was then immersed in the medium and the procedure was conducted as described. Temperatures were recorded at appropriate intervals during the 30-minute treatment period. The hand was then removed from the medium and allowed to cool; temperatures were recorded 5 and 10 minutes after removal.

**Continuous Immersion in Paraffin Bath.** The hand, wrist, and distal forearm were immersed for 30 minutes in a paraffin bath,\* the mean temperature of which was 127.0 F. (range from 125.0 to 128.0 F.). Unfortunately, there was no way to maintain the paraffin bath at a fixed temperature since the thermostat is preset. The subject was instructed not to move his fingers during treatment. Temperatures were recorded at 1, 2, 3, and 5 minutes after immersion and at 5-minute intervals thereafter during the treatment period.

\*Dickson Paraffin Bath Model BB, manufactured by the Thermo-Electric Company, 1012 W. Superior Ave., Cleveland 13.

**Dip-Immersion in Paraffin Bath.** The hand, wrist, and distal forearm were dipped slowly several times in paraffin, until a thin coating of solidified paraffin formed over the area; it was then immersed in the paraffin bath for 30 minutes. The mean temperature of the bath was 126.0 F. (range from 124.0 to 129.0 F.). Temperatures were recorded as for the continuous immersion technic.

**Dip-Wrap in Paraffin Bath.** The hand, wrist, and distal forearm were dipped slowly ten times in paraffin; the dipping usually required slightly longer than one minute. A thick, glovelike layer of solidified paraffin formed over the immersed area. After the tenth dip, the area was wrapped in wax paper and two bath towels and allowed to rest in the subject's lap until 30 minutes had elapsed from the time of the first dip. The mean temperature of the paraffin bath was 127.0 F. (range from 125.0 to 128.0 F.). Temperatures were recorded as for other paraffin technics.

**Hand Bath.** The hand, wrist, and distal forearm were immersed in hot water at a mean temperature of 110.0 F. (range from 109.0 to 110.0 F.) for 30 minutes. The whirlpool tank was utilized for this procedure without agitation of the water. Temperatures were recorded as for the paraffin technics.

**Whirlpool Bath.** The hand, wrist, and distal forearm were immersed in hot water at a mean temperature of 110.0 F. (range from 109.0 to 110.5 F.) for 30 minutes. The water was vigorously agitated by means of a turbine ejecting air and water under pressure into the whirlpool tank. Temperatures were recorded as for the paraffin technics.

**Contrast Bath.** The hand, wrist, and distal forearm were immersed alternately in hot water at a mean temperature of 110.0 F. and in cold water at a mean temperature of 65.0 F. for a total treatment period of 30 minutes. The sequence of treatment was as follows: 10 minutes in hot water, 1 minute in cold water, 4 minutes in hot water, 1 minute in cold water, 4 minutes in hot water, and so on until 30 minutes had elapsed. Temperatures were taken before, during, and after the contrast bath at appropriate

intervals to demonstrate the changes in skin and in interface readings.

### Results

**Continuous Immersion in Paraffin Bath (Fig. 2).** The highest skin temperature was 114.0 F. and the highest interface temperature was 117.5 F., both of which were recorded 5 minutes after immersion but for different subjects. The highest mean temperatures also were obtained at 5 minutes: 112.0 F. and 116.5 F. for skin and interface, respectively. After these top readings, the mean temperatures of skin and of interface gradually decreased to 109.5 and 113.5 F. Ten minutes after the end of immersion, the mean temperature of the skin was 96.0 F.

**Dip-Immersion in Paraffin Bath (Fig. 2).** The mean temperatures of the skin averaged about 1 degree lower than the corresponding temperatures during the continuous immersion procedure. The highest mean temperatures of skin and of interface were 111.0 and 115.5 F., respectively. The highest skin temperature was 112.0 F., and the highest interface temperature was 116.0 F.

**Dip-Wrap in Paraffin Bath (Fig. 2).** The highest mean temperatures of skin and of interface were recorded 2 minutes after the first immersion: 108.5 and 113.0 F., respectively. After this peak, the temperatures fell rapidly to 100.5 and 101.0 F. within 15 minutes and to 99.5 and 99.5 F., respectively, at the end of the treatment.

**Hand Bath (Fig. 3).** The highest mean temperatures of skin and of interface occurred midway through treatment, 107.0 and 109.0 F., respectively.

**Whirlpool Bath (Fig. 3).** The highest mean temperatures of skin and of interface were 108.0 and 110.0 F., respectively.

**Contrast Bath (Fig. 4).** The highest mean temperatures of skin and of interface were 107.0 and 109.5 F., respectively; and the lowest were 81.5 and 68.0 F., respectively.

### Comment

Of the three paraffin technics evaluated in this paper, the continuous



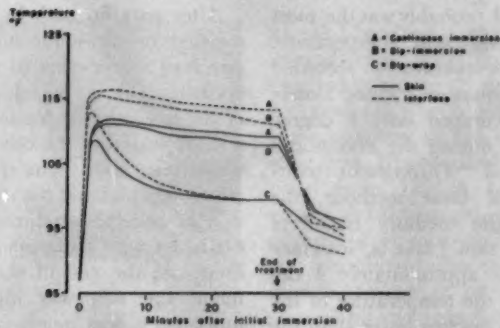


Fig. 2—Line graph of mean temperatures of skin and of interface in five normal persons before, during, and after each of three methods of paraffin bath to the hand.

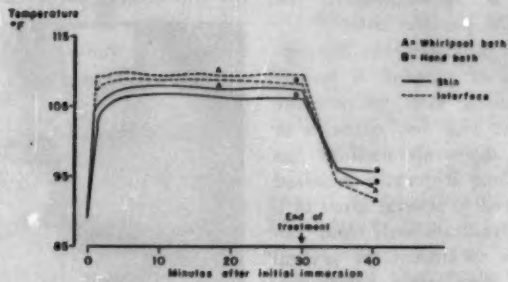


Fig. 3—Line graph of mean temperatures of skin and of interface in five normal persons before, during, and after each of two methods of hydrotherapy to the hand.

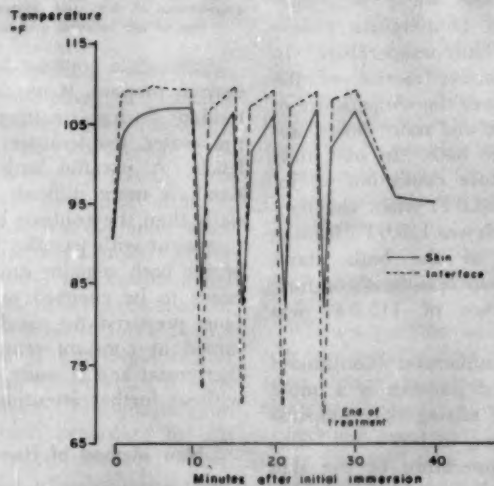


Fig. 4—Line graph of mean temperatures of skin and of interface in five normal persons before, during, and after contrast bath to the hand.

immersion method probably was the most effective in raising skin temperature. However, skin temperatures recorded during the dip-immersion method closely paralleled and averaged only 1 degree lower than those during the continuous immersion method. Throughout treatment by both of these methods, the temperature of the medium in direct contact with the skin (that is, interface temperature) was approximately 4 degrees higher than the temperature of the skin, but 10 to 15 degrees lower than the temperature of the paraffin bath. These findings would refute the assumption no doubt made in the past that the temperature of the solid paraffin in contact with the skin is approximately the same as that of the paraffin bath.

This study also indicates that the dip-wrap application of paraffin is largely ineffective in raising skin temperature except during the first few minutes of treatment. The dip-wrap method has been utilized because it permits localized heat to be delivered to several areas of a patient's body simultaneously and because it permits treatment of several patients at the same time using one paraffin bath.

At equivalent temperatures, the whirlpool bath appears to be more effective than the hand bath in raising skin temperature. When the water is greatly agitated, the skin temperature closely approximates the bath temperature. In the hand bath, active motion of the hand promptly causes the temperature of the skin to increase and more closely approach that of the bath. In our study the skin temperature could not be increased beyond 108.0 F. when the temperature of the bath was 110.0 F. Raising the temperature of the bath above 110.0 F. produced increasing discomfort; a bath temperature of 115.0 F. was intolerable.

In conclusion, immersion (continuous or dip) in melted paraffin is a more effective means of raising skin temperature than immersion in hot water. The highest mean temperature of the skin during continuous immersion in paraffin was 112.0 F., while the highest during immersion in hot water was 108.0 F.

After paraffin bath by continuous immersion or dip-immersion technics, the skin had a moderate to marked mottled erythema (fig. 5) which persisted in two of the five subjects for four to six hours; it disappeared in the other three subjects within one hour. The three hydrotherapeutic technics and the dip-wrap application of paraffin produced a mild, dusky erythema which disappeared within one hour. At the end of the paraffin treatment, the skin was ideally suited for massage; it was moist, smooth, and oily and it remained so for several hours. However, after hydrotherapy, the skin was dry and wrinkled and devoid of oily material. No harmful effects of any of the baths were observed.

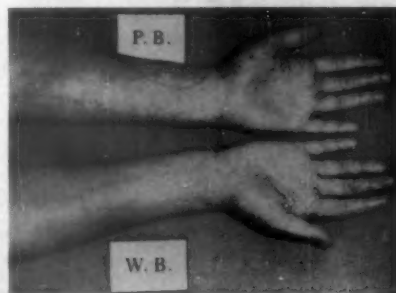


Fig. 5 — Comparison of appearance of hands, wrists and forearms of one subject after simultaneous immersion of distal segment of right arm in whirlpool bath (W.B.) and of left arm in paraffin bath (P.B.). Note mottled, more intense hyperemia, oily appearance of skin; and dilated veins after immersion of left forearm and hand in paraffin.

Although a contrast bath is relatively easy to prepare, it requires constant attention during treatment to maintain the water temperature at the desired levels. A paraffin bath, on the other hand, is more difficult to prepare initially than the contrast bath, but during treatment with paraffin the temperature of the bath remains quite constant and needs to be checked only infrequently. Once prepared, the paraffin bath is maintained at constant temperature by the thermostat and is ready for repeated use without further attention.

#### New Method of Home Treatment

For many years, the standard technic for giving the paraffin bath in the home was that described by Krusen<sup>9</sup> in 1937.



Fig. 6 — Electric roaster in use as paraffin bath.

Briefly, this method consists of placing water in the lower part of a double boiler and of placing 8 pounds of paraffin and 2 cups of mineral oil in the upper portion. After the paraffin has been melted by heating, the double boiler is removed from the stove and allowed to cool. When the temperature of the melted paraffin is 130 F. or less, which requires a period of usually 1 or 2 hours, the hand is dipped several times into the paraffin and then wrapped in towels. Care must be taken to prevent the hand from touching the sides or bottom of the boiler.

Today, in comparison with other methods of thermotherapy, this technic has serious limitations. Even major department stores do not stock large double boilers. A patient having arthritis probably would have great difficulty moving or lifting such a container when it is full. If paraffin is spilled on the stove, a fire can start. The double boiler is not large enough to accommodate the foot and ankle or the wrist, forearm, and elbow. With such a small quantity of paraffin, a uniform temperature is most difficult to maintain. The preparation of the paraffin bath according to this technic requires much time and effort.

Because of the disadvantages and dangers of the double-boiler technic in giving the paraffin bath in the home, a different method has been recommended

at the Cleveland Clinic during the past several years. The patient has been instructed to secure an electric roaster (fig. 6), preferably with timer and cabinet; a thermometer of the candy or pasteurizing type; 20 pounds of paraffin (melting point from 125 to 127 F.); and 1½ quarts of light-weight, white mineral oil. Because it is somewhat difficult to obtain paraffin of this melting point, this item is stocked in our pharmacy. The mineral oil and paraffin are added to the roaster and heated until the paraffin is melted, at which time the roaster is disconnected and allowed to cool. When the temperature of the paraffin reaches 128 F. and a thin layer of solidified paraffin forms on the surface, the patient dips his hand into the paraffin bath several times and finally immerses it for 30 minutes. A printed sheet of home instructions for the paraffin bath is given the patient (fig. 7).

With this method, there is no fire hazard, no need for lifting the unit, and little danger from burns since the sides of the roaster are not hot. A major advantage of the roaster is that its size permits treatment of the foot and ankle, or the hand, wrist, and forearm, or the elbow, and allows the patient to assume a comfortable position during the 30-minute treatment. The large amount of paraffin assures uniform temperature throughout the treatment period. Although the cost of such an electric roaster is more than that of a double boiler, it is not great and the equipment may later be used for cooking when there is no further need for treatment. Many patients already have such roasters in their homes.

#### Deodorant Compound

When a paraffin bath is used repeatedly, the paraffin develops a disagreeable odor. Since changing the paraffin and cleaning the bath is difficult and time consuming, one year ago we began to use a solution\* that is designed to mask this unpleasant odor. A small amount

\*The solution is sold under the trade-mark name "Paraffin Blend" and may be obtained by writing to the Thermo-Electric Company of Ohio, 2372 W. 7th St., Cleveland 13, Ohio.

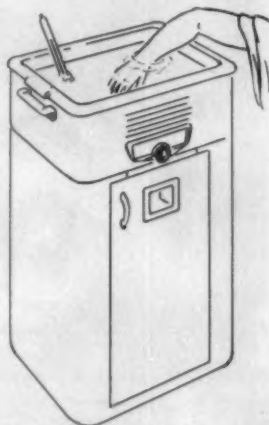
## INSTRUCTION FOR HOME PARAFFIN BATH

## EQUIPMENT:

- 1 electric roaster with timer and cabinet.
- 1 thermometer (candy or pasteurizing type).
- 20 pounds paraffin (125-127 AMP refined wax).
- 6 cupsful white mineral oil, Saybolt Viscosity 125/135.

## PROCEDURE:

- (1) Cut paraffin into 4 x 4 inch squares. Pour mineral oil into roaster and add as many pieces of paraffin as possible. Put cover on roaster.
- (2) Set temperature of roaster at 250° F. and timer at 1 hour. As paraffin melts, add remaining pieces.
- (3) After 1 hour, reset timer for 30 minute periods until paraffin is completely melted.
- (4) Remove cover and disconnect roaster. WHEN THE THERMOMETER REGISTERS 126° F. OR LESS AND A THIN LAYER OF SOLIDIFIED PARAFFIN FORMS ON THE SURFACE, THE BATH IS READY FOR USE.



## APPLICATION TO HANDS: (DO NOT WIGGLE FINGERS DURING TREATMENT)

- (1) Dip hand into paraffin, being careful not to touch bottom of roaster.
- (2) Remove hand from roaster for a few seconds. Then dip again and remove. Repeat several times until glove is formed.
- (3) Then immerse hand in paraffin and allow to remain there for 30 minutes.
- (4) After 30 minutes, remove paraffin glove from hand and allow that paraffin to slip back into roaster.

NOW THE HAND IS READY FOR THE MASSAGE AND EXERCISES PRESCRIBED BY YOUR PHYSICIAN.

Fig. 7 — Instruction sheet for use of electric roaster as paraffin bath.

(approximately 5 cc.) of the solution added to the paraffin bath prevents the development of odors for from 3 to 5 weeks. Our consultant in dermatology has assured us that this small amount of solution when dissolved in such a large amount of paraffin could not cause adverse skin reactions. We have observed no untoward reactions in our patients who have been treated with paraffin baths containing this solution.

## Summary

With thermistors, temperatures of the skin of the hand of each of five normal adults were determined before, during, and after immersion in a liquid medium. Concomitantly, temperatures of the me-

dium in direct contact with the skin (interface temperatures) also were obtained. The effects of six different immersion procedures on these temperatures are compared. The six procedures are: in paraffin, continuous immersion, dip-immersion, and dip-wrap; in water, hand bath, whirlpool bath, and contrast bath.

Continuous immersion and dip-immersion in liquid paraffin (at from 124.0 to 129.0 F.) caused rises of the mean skin temperature to 112.0 and 111.0 F., respectively, with no discomfort to the patient. Throughout the treatment, the mean temperature of the medium in contact with the skin averaged 4 degrees higher than that of the skin. With immersion of the hand in water (at from



109.0 to 110.5 F.), the mean skin temperature never exceeded 108.0 F.

The dip-wrap method of paraffin application (10 successive dips of the hand in the paraffin bath followed by wrapping of the hand in wax paper and towels) caused only a brief effective increase in skin temperature. The method is considered inferior to technics that entail continuous immersion of the hand in paraffin throughout the 30-minute treatment period.

The paraffin technics produced a more intense, more persistent hyperemia of the immersed part than did the water technics. The skin after immersion in paraffin is moist, smooth, and oily rather than dry and wrinkled as it is after immersion in water.

Continuous immersion in liquid paraffin at from 124.0 to 129.0 F. is an effective, safe, and convenient way of applying heat to the distal portions of the extremities. An ordinary electric roaster can be easily adapted for use as a paraffin bath in the home. Disagreeable odors of paraffin that occur after repeated use of a paraffin bath can be

prevented by the addition of a deodorant solution to the bath.

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## SUCCESS IS THE KEYNOTE

of our Philadelphia — 1958 meeting! An interesting scientific exhibit will contribute much to our success. In addition to the tremendous value of these exhibits, YOU have the opportunity to be considered for one of the coveted awards. Requests for applications for scientific exhibit space in connection with the 36th annual session scheduled for August 24-29, 1958, Hotel Bellevue-Stratford, Philadelphia, are now being received. Official blanks are mailed on request. Address all communications to the American Congress of Physical Medicine and Rehabilitation, 30 N. Michigan Ave., Chicago 2, Illinois.

# Use of Cinefluorography for Evaluation of Normal and Abnormal Motion in the Neck

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● A fluoroscopic intensifier system is described which makes possible the use of cinematographic recording of cervical vertebrae during motion. This apparatus exposes the patient to less radiation than does an ordinary fluoroscopic examination. The positions and relationships of the vertebrae through the full range of motion are recorded on 16 mm. film at 16 frames per second. Studies of normal and abnormal relationships are demonstrated.

Evaluation of motion in the neck is a difficult process. The multiple and complex joints of the cervical vertebrae allow a wide range of motion. Where there is limitation of motion because of involvement of one joint, compensation may occur at other joints. The very short cervical vertebrae and their overlapping joints make it difficult to localize the joint which is involved when there is limitation of motion. In the absence of changes of bony structure it is rarely possible by a physical examination or by x-ray to specifically localize the point of abnormality. Most frequently limitation of motion in the neck is associated with changes in soft tissues rather than changes in the bony structure of the vertebrae. Consequently, it is necessary to diagnose by inference on the basis of the vertebral relationships rather than by direct demonstration of an abnormality.

The ordinary roentgenographic evaluation of the neck usually involves anteroposterior, lateral, and oblique x-rays either in the normal position or at the extremes of motion. Changes in the relationship of the vertebrae to one another or loss of the normal curve is evidence that an abnormality exists. However, these x-rays do not demonstrate directly the changes of function or dyssynergy which occur following damage to soft tissues. The development of the image intensifier cinefluorograph as a machine which can make a moving picture record of a fluoroscopic screen makes it possible to observe the cervical vertebrae as they move and to see the localized restricted or abnormal motion,

or dyssynergy, which has been caused by injury or disease.

## The Image Intensifier Cinefluorograph

The essential unit of the cinefluorographic instrument is an electron accelerator which intensifies the fluoroscopic image. This unit can be operated from the ordinary x-ray tube normally used for fluoroscopy with an output of 1 to 10 milliamperes at 70 to 100 kilovolts. The tube output during these cinefluorographic studies was controlled by a photocell in a balancing circuit at less than 10 milliamperes and no more than 85 kilovolts.

The x-ray beam which passes through the patient is transformed into a conventional fluoroscopic image by the fluorescent screen at one end of the intensifier tube (fig. 1). This fluoroscopic image is converted into an electron pattern by an adjacent photoelectric surface. The electrons discharged from this photoelectric surface are accelerated as they pass through the tube by a high potential produced by an external source and then impinge on a smaller output phosphorescent screen to intensify the fluorescent image 400 times. Magnification of this intensified small fluorescent image by optical lenses does not result in a reduction of brightness. The fluorescent image produced at the emitting screen is projected through a mirror which transmits 95 per cent of the visible rays to the camera and reflects 5 per cent of the rays through an optical system to a mirror which is viewed by the roentgenologist (fig. 2).

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Department of Physical Medicine and Rehabilitation, University of Minnesota Medical School.  
Department of Radiology, University of Minnesota Medical School.

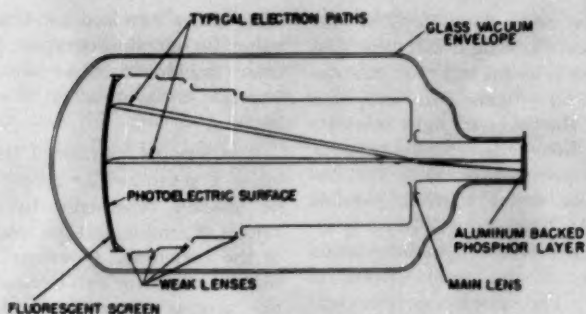


Fig. 1 — Schematic diagram of the image intensifier tube of the cinefluorograph. A 30,000 volt potential accelerates the electrons emitted from the photoelectric surface in contact with the input fluorescent screen. The accelerated electrons are concentrated on a small output phosphor to produce a 400-fold increase in the intensity of the fluorescence.

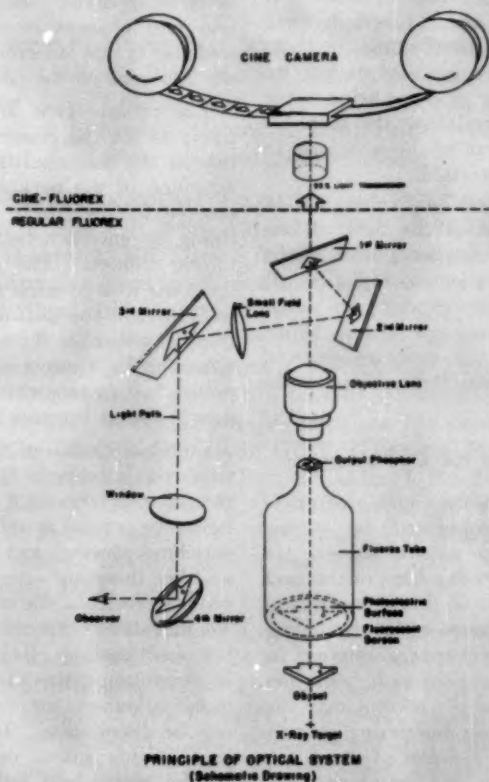


Fig. 2 — Schema of the optical system of the cinefluorograph. The image intensifier tube produces at the output phosphor a fluorescent image 400 times brighter than that on the fluorescent screen. The optical system magnifies this image to normal size without loss of intensity. A mirrored window transmits 95 per cent of the visible light to the camera and reflects 5 per cent through a mirror system to be viewed by the observer.

Whereas ordinary fluoroscopy is carried out at such low light intensity that only rod vision is useful and dark adaptation is necessary, when the amplifier tube is used the level of light intensity produces an image perceptible by cone vision. This provides much better discrimination of detail than is possible with standard fluoroscopy. It also obviates the necessity for light adaptation of the rods of the retina prior to fluorography. The light intensity is great enough so that, with sensitive film, motion pictures at 15 or 30 frames per second can be exposed. The x-ray tube is synchronized with the camera shutter so that radiation is emitted only during the interval that the film is exposed. This reduces the radiation of the patient to 50 per cent of the exposure which would occur without this synchronization. A very high speed film, Linagraph Shell Burst, was used in these studies in order to minimize the exposure of patients to radiation. Further study is being made of techniques for producing the maximal definition and detail of the structures in which we are interested.

During the cinefluorographing at 15 frames per second of the neck of one patient, measurements were made of the exposure of the patient to radiation. It was found that the exposure to radiation was 8 roentgens per minute, which is just equal to the exposure received during conventional fluoroscopy of the same area.

#### Interpretation of the Cinefluorogram

Interpretation of the cinefluorogram of the neck is complicated by certain factors. Standard anteroposterior, lateral, and oblique x-ray films of the neck are often difficult to interpret because of overlapping shadows. When the patient moves or presents a nonfamiliar view, there may be even more confusion. The mandible and the occiput may cast obstructing shadows interfering particularly with the evaluation of the upper three or four cervical vertebrae. The evaluation of the axio-atlantoid joints or the atlanto-occipital joints is extremely difficult because of this interference. The moving jaw technic for exposure of the

atlas under standard conditions is of no value for cinefluorography. In spite of these drawbacks, there are certain advantages to be obtained from a moving picture.

The moving picture of the neck provides a reproducible record which can be studied repeatedly to observe the ranges of motion and the relative motions of the vertebrae. Questionable relationships of vertebrae can be observed during the process of motion and a decision made regarding abnormality. In the lateral or the oblique views it is possible to observe the sliding that occurs in the apophyseal joints during flexion or extension of the neck. Restriction of motion at one vertebral level or dyssynchrony of motion of one vertebra with the rest of the neck due to muscle spasm becomes apparent. Abnormalities of motion and changes in compression and wedging of the intervertebral discs also are apparent on the lateral view.

The oblique view affords an opportunity to see the constriction or expansion of the foramina during flexion or extension of the neck. It is possible to observe whether there is unusual overriding or encroachment on a foramen during motion. The changes of the foramina with rotation are more difficult to evaluate. The shift of the vertebra as it rotates changes the view of the foraminal orifice from a perpendicular exposure to a tangential exposure and interpretation becomes more difficult.

Cinefluorograms of fractures demonstrate the stability or lack of stability of the fracture fragments. It is possible to follow the normal as well as the abnormal vertebrae during motion and to see whether there are unusual shifts of any cervical vertebra during motion which would indicate that the fractured vertebra is still unstable. This will be valuable in determining the time at which immobilization of the cervical vertebrae may be discontinued. In the presence of acute muscle spasm, or inflamed joints, the joints are held rigidly immobilized. Standard physical examination of the patient under these conditions usually shows restriction of motion of the neck associated with pain on certain motions,



but it is not possible to localize accurately where the restriction occurs or how much compensation occurs at other joints. On the cinefluorogram, however, it is evident that the restriction of motion in the involved area is nearly complete and that compensation occurs in other joints.

#### Summary

Records of motion of the cervical

vertebrae give us new information concerning normal as well as abnormal necks. Before this technic can be used to fullest value, standards of normal variations of vertebral motion will have to be established as a basis for evaluating abnormal cervical motion. This method gives promise of providing a much more sensitive tool for objectively evaluating and recording the motions of the cervical vertebrae.

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## Res ipsa loquitur!

CHICAGO SOCIETY OF PHYSICAL MEDICINE AND REHABILITATION meets April 18, 1958 at Rest Haven Rehabilitation Hospital, 1401 S. California Ave., Chicago. Dr. Morton Hoberman of the College of Physicians & Surgeons, Columbia University, New York City will discuss *An Evaluation of Bindegegewebesmassage*.

EASTERN SECTION, AMERICAN CONGRESS OF PHYSICAL MEDICINE AND REHABILITATION will meet April 19, 1958 at National Institutes of Health, Bethesda, Md. *Brief Isometric Exercises; How One Semi-Rural State Has Organized to Attack Its Problem of Chronic Illness, Disability, and Old Age; Systematic Physical Management of the Patient with Rheumatoid Arthritis; Rehabilitation of Paraplegias; Rehabilitation of the Quadriplegic; Physical Therapy in Cerebral Vascular Disease, and Rehabilitation of Sensory Defects Involving the Extremities in the Brain Injured* are the topics scheduled for presentation. Speakers include W. T. Liberson, Mordechai M. Asa, Robert P. Smith, Carl V. Granger, Albert A. Martucci, Tumkur Madhu, Earl F. Hoerner, J. Peter Murphy, Francis M. Forster, Charles D. Shields, and A. F. Mastellone. For detailed program copy write Isadore Levin, M.D., Secretary, 1801 Eye St., N.W., Washington, D. C.

MIDWESTERN SECTION, AMERICAN CONGRESS OF PHYSICAL MEDICINE AND REHABILITATION will meet May 2, 1958 at Milwaukee Children's Hospital, Milwaukee, Wisc. *The Problem of Children with Legs of Unequal Length; The Conservative and Surgical Treatment of Scoliosis in Children; The Management of Thoracic Lesions in Children, and The Problems of the Child Amputee* are the topics scheduled for presentation. Speakers include Walter P. Blount, Albert C. Schmidt, H. M. Coon, Wilson Weisel, and William H. Frackelton. For detailed program copy write Adeline B. Gauger, M.D., Secretary, 1121 N. Waverly Pl., Milwaukee 2, Wisc.

# Effects of Delayed Electric Stimulation on Experimentally Denervated Muscle

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(with the technical assistance of Robert Arns)

• The effects of immediate and delayed electric stimulation were compared in an attempt to determine whether delayed electric treatment would help denervated muscle in a manner commensurate with the help afforded by immediate electric stimulation. Adult albino rats were used—normal controls and seven groups denervated by excision of a long segment of the sciatic and femoral nerves of the left extremity at the base of the thigh. At the end of the treatment period of 30 days the tendo achillis of the left leg in each rat was separated from its insertion and connected to the work output machine for determination of the initial and total work output of the gastrocnemius, soleus, and plantaris muscles. The findings clearly indicate that delayed electric stimulation did not improve the work output and endurance of denervated muscle.

In spite of the fact that some controversy still exists as to whether or not electric stimulation of denervated muscle is beneficial, recent work<sup>1-5</sup> has provided convincing evidence that therapeutic electric stimulation retards loss of weight and reduction in strength of paralyzed muscle. Appropriate electric stimulation has led to a stronger and heavier muscle during denervation as well as during recovery.<sup>6</sup>

The best results were obtained when electric treatment was started immediately after denervation.<sup>5</sup> Early treatment was more effective than late in retarding both the atrophy and the fibrosis.<sup>1, 2</sup> Osborne and associates<sup>7</sup> obtained a good degree of correlation between the increase in girth and the increase in strength of the paralyzed extremities of poliomyelitis patients treated by electric stimulation.

Krusen and the author<sup>8</sup> found that the work output and the endurance of denervated, electrically stimulated muscle were greater than those of unstimulated muscle. However, our findings clearly demonstrated that electric stimulation neither completely prevents the reduction of, nor completely replenishes, the power of denervated muscle to do work such as it should do when its connections with the nervous system are intact as is true of normal controls. In the present study the effects of immediate and of delayed electric stimulation on denervated muscle were compared. The aim was to determine whether any, or how

much, benefit can be derived from stimulating a completely denervated muscle after it has had time to undergo severe atrophy for a period of 30 days before electric stimulation is started.

## Methods

This study was made on adult, male, albino rats of practically the same age and weight. Litter mates were divided into several groups. Those of group 1 were used as normal controls, that is, the muscles were neither denervated nor stimulated. The animals in groups 2 to 8 inclusive were subjected to denervation of muscles by excision of a long segment and evulsion of the proximal and distal stumps of the sciatic and femoral nerves of the left extremity at the base of the thigh. The excision and evulsion were done for the purpose of making unlikely the possibility of regeneration of the nerves during the period of study. Treatment of the paralyzed extremity by electric stimulation was given once every half hour throughout the 8-hour day for 30 days. The stimulating pulse was a square wave of 1 millisecond duration and the intensity was maximal, but the frequency of impulses and the duration of treatment are specified for each stimulated group.

Electric stimulation for 15 minutes every half hour at a frequency of 16 impulses per second was instituted in the animals of group 2 immediately after denervation and in group 3 after a delay of 30 days. The muscles of the animals in group 4, immediately after denervation, and those of group 5, after 30 days of delay, were stimulated for 5

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minutes every half hour at a frequency of 16 impulses per second. The muscles of the animals in group 6, immediately after denervation, and those in group 7, after a delay of 30 days, were stimulated electrically for 15 minutes every half hour at a frequency of 1 impulse per second. The animals in group 8 were used as denervated, untreated controls, that is, they were subjected to denervation but were kept untreated under identical kennel conditions for 30 days. At the end of the treatment period, which lasted for 30 days, the tendo achillis of the left leg of each animal, under pentobarbital sodium (Nembutal) anesthesia, was separated from its insertion and connected to the work-output machine for determination of the initial and total work output of the gastrocnemius-soleus-plantaris muscles, as described previously.<sup>8</sup>

### Results

The findings recorded in the accompanying illustration clearly indicate that the beneficial effects obtained by electric stimulation of denervated muscle initiated immediately after denervation and continued for one month are not obtained by electric treatment that is delayed for one month after denervation. The findings in groups 4 and 5 illustrate the difference between immediate treatment and delayed treatment by electric stimulation in their effect on the work output and endurance of denervated muscle. The muscles of the animals of

group 4, which were given electric stimulation that consisted of 16 impulses per second for 5 minutes every half hour throughout the 8-hour day and that was initiated immediately after denervation and was continued for 30 days, had a mean work output of 55.3 per cent during the first 100 seconds and a mean total work output of 51.0 per cent of that of the intact normal muscles. The animals in group 5 were treated like those in group 4 in every way except for the electric treatment, which was intentionally delayed for 30 days but which was otherwise similar. The mean work output of the muscles of animals in group 5 was only 20.7 per cent of that of intact normal muscles during the first 100 seconds, and the total work output was only 10.9 per cent per 100 seconds.

Thus, a delay of 30 days after denervation made electric stimulation induce a mean initial work output of only 20.7 per cent of normal during the first 100 seconds, while electric stimulation initiated soon after denervation gave a work output of 55.3 per cent of normal. Also, the mean total work output for the muscles electrically stimulated immediately after denervation was 51 per cent of normal, while for those not stimulated electrically until one month had elapsed after denervation, it was only 10.9 per cent of normal.

It is evident that the initial as well as the total work output was consistently low in the various groups in which

(Work Output in Per Cent Of Normal)

MUSCLE	INITIAL WORK OUTPUT (1st 100 seconds)	TOTAL WORK OUTPUT (Average/100 seconds)
Normal, Unstimulated	100%	100%
<b>DENERVATED, STIMULATED</b> (16/sec., 15 min. q. ½ hr.)	40.5%	36.5%
	17.3%	10.4%
(16/sec., 5 min. q. ½ hr.)	55.3%	51.0%
	20.7%	10.9%
(1/sec., 15 min. q. ½ hr.)	31.2%	13.0%
	21.9%	9.9%
Denervated, Unstimulated	37.1%	14.1%

\*Stimulation was started immediately after denervation and was continued daily for 30 days

†Stimulation was started 30 days after denervation and was continued daily for 30 days

Comparison of the effects of immediate and delayed electric stimulation on denervated muscle.

electric treatment was delayed for 30 days after denervation as compared to the output in the groups in which treatment was started immediately after denervation, no matter what duration or frequency of stimulation was given. The muscles given delayed electric treatment did not even do as well as those that were denervated but were not given any electric treatment whatsoever. The data on work output in percentage of normal are summarized graphically in the figure, which emphasizes the observation that delayed electric stimulation is of no benefit to completely denervated, atrophied muscles. Furthermore, the results of this study confirm the previous finding that electric stimulation at a frequency of 1 impulse per second is not as effective as 16 impulses per second.

#### Comment

The major findings in this study suggest that no matter how often and at what frequency or duration electric treatment is initiated after the muscles have been completely denervated and have been given enough time to atrophy (30 days), no beneficial effects are obtained by the atrophied muscles. Evidently the degenerative and atrophic changes that take place in untreated skeletal muscle during the 30-day period after complete loss of its entire nerve supply cannot be rectified in the absence of any possible reinnervation.

According to the Sunderland's classification<sup>9</sup> of peripheral nerve injuries, complete severance of the motor nerve trunk is a fifth-degree injury of peripheral motor nerves. In order to make recovery unlikely for the duration of the experiments in the present study, not only were nerve trunks excised but also the peripheral and central stumps were evulsed. This was done to produce a condition somewhat similar to a clinical state wherein the nerves have been destroyed so effectively that regeneration becomes impossible, especially if the nerve cells are involved. It was not necessary to destroy the nerve cells in this experimental study because the duration of the period of study was not

indefinite. The findings support the suggestion that, in the presence of complete atrophy and degeneration due to total denervation and in the absence of any possibility of reinnervation, electric stimulation is not beneficial. It appears futile to treat totally denervated, completely atrophied muscle when the possibility of reinnervation is definitely unlikely.

#### Summary

Findings in experimental rats clearly indicate that no matter what impulse frequency or duration of treatment is used, delayed electric stimulation started 30 days after complete denervation does not improve the work output and endurance of denervated atrophied muscle.

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# Rehabilitation of the "Permanently and Totally Disabled" Patient

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● Preliminary results of a pilot program to rehabilitate the "permanently and totally disabled" welfare recipient are reported. The areas of improvement included self-care activities, vocational potentialities, ambulation status, and living arrangements. While these results are most encouraging, especially since the gains have been maintained in practically all patients reviewed for at least six months following discharge from the hospital, they cannot be considered final. In many instances difficulties in the patient's total adjustment encountered after discharge, such as in housing or employment, may nullify much of the benefit previously achieved.

The scope and details of this pilot program to rehabilitate disabled welfare recipients were recently reported.<sup>1</sup> The program is a joint effort of the Departments of Health, Social Welfare and Education of the State of New York, and is being carried out at the New York State Rehabilitation Hospital at West Haverstraw. Briefly stated, the purpose of the program is to find out how many disabled adults on public assistance can be helped, even to the point of making them employable. The project is also intended to explore the results of intensive application of rehabilitative techniques, and to obtain information on the costs, personnel, and facilities which would be required for a continuing program. The study will, in addition, endeavor to determine actual and potential savings to the taxpayer, and monetary, social, and other gains to the individual and his family, which such a program could bring about. The patients studied on this pilot program were primarily selected from the Public Assistance Category of Aid to the Disabled. Practically all of these patients were further classified as "permanently and totally disabled." A few disabled persons with good rehabilitation potentialities in the Public Assistance Category of "aid to dependent children" and "old age assistance," or "home relief" were also admitted to the program.

The present report is concerned primarily with the information obtained regarding the medical rehabilitation of disabled adults on public assistance who could be restored to partial or full self-

care or to remunerative occupation. It is anticipated that additional reports will be made in the near future when the necessary and pertinent data concerning economic, vocational, and social rehabilitation are available.

As of April, 1957, 150 welfare recipients had been admitted to the hospital, evaluated, treated, and discharged: 53 per cent of the patients were males, 47 per cent females; 23 per cent were under 40 years of age, 58 per cent were from 40 to 60 years of age, 20 per cent were between 60 and 75 years (table 1). The conditions which produced the primary disabling effects resulting in the classification of these patients as "permanently and totally disabled" were as follows: arthritis, almost 25 per cent; cerebrovascular accidents, slightly over 20 per cent; transverse myelitis (infectious and traumatic), 15 per cent; multiple sclerosis, almost 10 per cent; malunited fractures, 9 per cent; acquired absence of limbs, 4 per cent. There were, in addition, some 14 other conditions which accounted for the remaining 16 per cent (table 2).

The rating scale in table 3, and explained in greater detail in tables 4 and 5, is our attempt to obtain some degree of objectivity in evaluating these patients insofar as their self-care and vocational potentialities are concerned. Each patient on admission to the hospital was given a complete medical examination, including laboratory studies, x-rays, and various medical consultations as necessary.

In addition, complete psychometric studies, social history, muscle test, range of motion test, activities of daily living test, and prevocational exploration were also done. These we usually complete

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Table 1: Age and Sex Distribution of First 150 Patients Discharged

Age	Male	Female	Total
Under 20	1	1	2
20-29	9	4	13
30-39	6	13	19
40-49	24	23	47
50-59	25	15	40
60-69	12	12	24
70-75	3	2	5
Total	80	70	150

Table 2: Diagnoses: First 150 Patients Discharged

Arthritis	37
Cerebral Vascular Accidents	33
Traumatic Transverse Myelitis	23
Malunited Fractures	13
Multiple Sclerosis	14
Absence Acquired Limbs	6
Miscellaneous	24
Total	150
Chronic Poliomyelitis	8
Herniated Intervertebral Disc	4
Muscular Dystrophy	2
Cerebral Palsy	2
Neuritis with Paralysis	2
Legg-Perthe's Disease	2
Friedreich's Ataxia	2
Hereditary Neuromuscular Disease	1
Syringomyelia	1
Osteomyelitis	1
Equinovarus Deformity	1
Chronic Low Back Strain	1
Postconcussion Neurosis	1
Myotonia	1
Total	24

Table 3: Rating Scale

Adm	Obj	Disch	Personal Care
			I Completely Independent Outside the Home
			II Requires Limited Assistance Outside the Home
			III Completely Independent at Home
			IV Requires Assistance at Home
			V Requires Custodial Care
Adm	Obj	Disch	Vocational
			A Full-time Independent Employment
			B Full-time Employment with Special Arrangements
			C Sheltered Workshop or Home Employment
			D Home Employment with Assistance
			E Not Employable

within one week after admission. The findings were reviewed by the attending physiatrist and the patient placed on a two-week period of preliminary treatment. This we found extremely valuable since it gave the hospital personnel an excellent chance to determine how the patient actually responded to therapy and to learn what the patient expected as a result of intensive rehabilitation.

At the end of the third week, the physiatrist, in conjunction with the other members of the rehabilitation team, reviewed the patient. The patient was given a rehabilitation rating, as noted in table 3. If the patient showed some potential for improvement, he was transferred to a full treatment status and a program of activities prescribed for him. In addition, the physiatrist selected a rehabilitation status as the objective for each patient. This, of course, was the ultimate anticipated goal for the patient. In addition, more immediate attainable goals were also set, so that motivation could be reinforced by achievement. Our experience to date indicates that, for the objectives set at the time of initial evaluation by the rehabilitation program, better than 75 per cent of all patients met or exceeded the goals set for them. In nearly 25 per cent of the cases the patient exceeded the goal which had been set for him at time of acceptance for the full program.

The rehabilitation evaluation of the first 150 patients discharged from the hospital is given in table 6. The figures below the diagonal line represent the status of the patients on admission; those above the diagonal line, the status at time of discharge. Of the 150 patients discharged under the program, 28, or 18.5 per cent, were not acceptable for or in need of the program, or left against medical advice. Rehabilitation status of this group at the time of discharge was usually the same as upon admission. One patient (a physician severely handicapped by poliomyelitis) refused to be evaluated and signed himself out the day after admission.

At the time of admission, more than 45 per cent of the patients required custodial care (category V). An additional

24 per cent were unable to take care of all their personal needs, even within the home area (category IV); 60 per cent were considered to be totally unemployable (category E), or its equivalent in the household activities. An additional 10 per cent could only assist someone else vocationally, or in the household area (category D). At the time of discharge, only 20 per cent remained in the category requiring custodial care (category V) and 15 per cent in category IV; 35 per cent remained unemployable (cate-

gory E), and 10 per cent remained in category D.

To accentuate the positive results, let us point out that on admission only 8 per cent were independent in the home area, 5 per cent outside the home with minimal assistance, and 16 per cent totally independent outside of the home. At the time of discharge, these percentages had increased to 15, 16, and 33 respectively. In other words, the number of patients who became physically independent in self-care, either within or outside the home, was doubled at the time of discharge.

Insofar as vocational status is concerned, on admission, 14 per cent were capable of taking care of most household activities or working in a sheltered workshop; 6 per cent could carry on full-time employment under special arrangements; and 6 per cent were capable of full-time competitive employment. On discharge, 25 per cent were capable of sheltered workshop activity, or its equivalent in the home; 16 per cent were capable of full-time employment with special arrangements; and 15 per cent were capable of full-time competitive employment.

Since some of the severely disabled patients were able to make gains without improving their classification in the rehabilitation status, as set forth in table 3, we have also evaluated our results by the

Table 4: Personal Care Rating Scale

- I COMPLETELY INDEPENDENT OUTSIDE THE HOME:** An individual who is completely independent with or without apparatus (braces, prosthesis, crutches, wheelchair) in all essential daily activities including elevation and public travel.
- II REQUIRES LIMITED ASSISTANCE OUTSIDE THE HOME:** An individual who is capable of performing the essential activities independently within the home, but who requires assistance occasionally or under special circumstances for elevation, travel and toilet activities, or else needs special arrangements, such as ramps, hand rails, toilet equipment, etc.
- III COMPLETELY INDEPENDENT AT HOME:** An individual who is able to care for himself during the day without requiring assistance, thus releasing someone else from the home.
- IV REQUIRES ASSISTANCE AT HOME:** An individual who is capable of functioning at home with minimal attendant care.
- V REQUIRES CUSTODIAL CARE:** An individual who may be able to sit in a wheelchair or stand with support, but who is essentially dependent upon attendant care for help in necessary personal care or daily activities such as eating, dressing, and toilet.

Table 5: Vocational Rating Scale

- A FULL-TIME INDEPENDENT EMPLOYMENT:** An individual who is capable of full-time competitive employment, or a housewife who is able to perform all household and child-care activities including shopping.
- B FULL-TIME EMPLOYMENT WITH SPECIAL ARRANGEMENTS:** An individual who is capable of full-time employment under special working conditions, such as a standing device, adaptive equipment, messenger service, etc.; also a housewife who can do household and child-care activities but cannot carry packages, manage a child in the carriage or perform heavy household duties not essential for the day-to-day management of the home.
- C SHELTERED WORKSHOP OR HOME EMPLOYMENT:** An individual who is capable of productive work in a sheltered workshop or at home, or a housewife who can manage most household and child-care activities, exclusive of shopping and heavy lifting.
- D HOME EMPLOYMENT WITH ASSISTANCE:** An individual who is able to carry on some functions of the business with assistance or who is able to help others in a business conducted at home; also a housewife who can assist others in household duties, or who would require help in performing daily household duties.
- E NOT EMPLOYABLE:**

Table 6: Rehabilitation Evaluation — Admission and Discharge

	A	B	C	D	E	
I	23	15	9	0	2	I
II	11	7	7	0	0	II
III	0	9	9	4	2	III
IV	0	3	4	0	1	IV
V	0	0	13	5	4	V
	0	0	4	3	5	
	0	0	2	6	15	
	0	0	7	12	17	
	0	0	1	0	28	
	0	0	0	1	67*	
	A	B	C	D	E	

Below line — Classification on admission.

Above line — Classification on discharge.

\*2 patients died (VE category).

1 patient not evaluated.

usual "marked," "moderate," "slight," and "none." (For example, a patient on admission is classified as V-E and is given the same status on discharge—apparently no change has taken place during this period of hospitalization. However, a quadriplegic patient may have learned to feed himself and shave himself with the aid of adaptive equipment, when such equipment is properly placed. He may also have learned how to assist an attendant in transfer activities. The patient truly is still custodial, but he has shown definite improvement and may be able to relieve his attendant of some duties.) We have correlated this type of evaluation with the disabling disease, as shown in table 7, and with age, as is shown in table 8.

Slightly over 20 per cent of all the patients showed marked improvement. A total better than 50 per cent showed either moderate or marked improvement. This was particularly noticed in arthritis, the residuals of the cerebrovascular accidents, and in the paraplegic and quadriplegic patients. Marked or moderate improvement occurred in 50 per cent of every age group, with the exception of the 70-75 year group.

We considered these results to be most encouraging, particularly since most of these patients had additional disease disability which made physical rehabilitation difficult. In this group of 150 patients, there were 185 conditions, each of which contributed to the difficulty in treatment, in addition to the actual disablement of the patient. The most frequent were the mental and emotional disorders of which there were over 50 (mental retardation, mental deterioration, psychoneurosis, chronic alcoholism, and even psychosis). Cardiovascular diseases accounted for the next largest group, there being close to 40 in this category (essential hypertension, rheumatic heart disease, arteriosclerotic heart disease, coronary artery disease, and abdominal aortic aneurism). There were at least 12 patients with very severe visual handicap, either in one or both eyes, and 10 who had severe hearing loss in both ears. Seven patients were severe diabetics. A good proportion of the transverse myelitis patients were admitted with decubitus ulcers and urinary lithiasis. Many of these patients, as well as some of the older patients, showed severe osteoporosis. Three patients devel-

Table 7: Status on Discharge According to Diagnosis

	Marked Improvement	Moderate Improvement	Slight Improvement	No Change	Died	Total
Arthritis .....	11	12	7	7	0	37
Cerebral vascular accidents .....	9	18	7	5	0	33
Transverse myelitis .....	5	6	5	5	2	23
Multiple sclerosis .....	0	5	4	5	0	14
Malunited fractures .....	3	4	3	3	0	13
Absence acquired limbs .....	1	2	1	2	0	6
Miscellaneous .....	3	8	6	7	0	24
Total .....	32	49	33	34	2	150

Table 8: Status on Discharge According to Age

	Marked Improvement	Moderate Improvement	Slight Improvement	No Change	Died	Total
Under 20 .....	0	1	1	0	0	2
20-29 .....	4	3	2	4	0	13
30-39 .....	3	6	5	4	1	19
40-49 .....	11	16	7	13	0	47
50-59 .....	10	15	9	5	1	40
60-69 .....	4	8	9	5	0	26
70-75 .....	0	0	2	3	0	5
Total .....	32	49	33	34	2	150



oped fractures (two of the femur and one of the humerus) while they were in this hospital. Three other patients developed gastrointestinal bleeding and one patient had to be transferred to a general hospital for intensive medical care (none of these patients were on corticosteroid therapy at the time that they developed the gastrointestinal bleeding). Of the entire group only 15 patients (10 per cent) had no other major disease or disability. Most of the disabilities for which the patients were admitted were of long duration; 80 per cent were of more than one year's duration. Of these approximately 50 per cent were of 1 to 5 years' duration, 20 per cent from 5 to 10 years' duration, and 30 per cent over 10 years' duration.

On admission, 59 of the patients (40 per cent) were considered to be bed-bound. At the time of discharge only 14 patients (9 per cent) were so considered. There were 35 patients who were considered in the wheelchair category on admission and 34 on discharge; 31 patients were considered to be ambulatory with aids on admission, and 58 were so considered on discharge; 25 patients were able to ambulate without aids or assistance on admission. However, on discharge there were 42 such patients.

An attempt was also made to evaluate the type of living arrangements that the patient had prior to admission and what we estimated he was capable of handling at the time of discharge. On admission, 31 patients were considered to be independent insofar as self-care activities were concerned within their own home. At the time of discharge, 74 patients were so considered. On admission, 50 of the patients were living at home but were dependent on the personnel within the home for self-care activities. At the time of discharge, only 26 patients remained in this category. Forty patients came to the hospital from nursing homes; only 26 were returned to nursing homes; 9 patients came from boarding homes or similar type of arrangement, 8 were returned to such living arrangements. Twenty patients came from general hospitals or similar institutions, only 3 returned to general hospitals at time of discharge.

Unfortunately, in 11 instances information was not currently available on the arrangements of the patients following discharge. A number of the patients who went to nursing homes could, in our opinion, have lived in boarding homes, were the latter available to them.

One final statistic: The average stay in the hospital of these 150 patients was 160 days with the range varying from 1 day to 450 days. Here it should be noted that in many instances the patient had to remain at the hospital for somewhat longer periods than was deemed absolutely necessary. This was done in order to allow the welfare agency or the patient's family, or both, to make adequate arrangements for the return of the patient to his community. Wherever possible we gave the welfare agency or the family at least 30 days notice prior to discharge. In most instances this was adequate, however, in a considerable number of instances, the patient had to stay at the hospital beyond the date we had set for discharge.

#### Comment

We should like to emphasize that this is a report of a pilot program in which an attempt was made to determine whether or not it is possible to rehabilitate the "permanently and totally disabled" welfare recipient. That physical rehabilitation is possible in adequately screened patients has, we believe, been shown. We had hoped to be able to include a 6-month follow-up report on all of these patients. Due to personnel difficulties, the follow-up studies have not been completed. We do however have data on 35 patients. Practically every patient has maintained all of the gains in self-care activities that were made while he was at the hospital. The results have not been as uniformly good in the total adjustment of the patient after discharge. The following partial case reports are cited as examples:

*Case 1.*—A patient with traumatic paraplegia had come from a general hospital. At the time of discharge, he was considered to be able to live at home. However his parents were now ill and

not capable of taking care of themselves. As a result, the patient had to be sent to a nursing home.

*Case 2.*—A hemiplegic patient had come from a nursing home where she had been for four years (category IV-E on admission). At time of discharge, we considered her to be able to live alone in an apartment, and capable of doing everything but heavy lifting and cleaning. The Department of Welfare has been unable to locate a suitable apartment for her and, as a result, this patient also had to be sent to a nursing home.

*Case 3.*—A patient had been unemployed for 8 years prior to admission because of severe rheumatoid arthritis. At the time of discharge, the patient was considered to be employable full time with special arrangements (II-B). He had had considerable vocational exploration and had been placed in an actual job situation for one month at the hospital. On his return home, he was unable to obtain employment even with the help of the Division of Vocational Rehabilitation (for on-the-job training) and the Special Placement Bureau of the State Employment Agency. One of the major obstacles was his age (55 years), which, in our experience, has been most difficult to overcome insofar as re-employment is concerned. We have only to look at the employment difficulties encountered by the physically able in the same age group to realize the barrier that the physically restored disabled are encountering.

One other topic deserves some comment. Within the past year, the Congress has enacted legislation which will entitle anyone past the age of 50 to social security benefits, providing he is in the System, certified to be "permanently and totally disabled," and has signified his willingness to undergo intensive rehabilitation, if it is so recommended.

It is therefore very possible that in the near future those in the specialty of physical medicine and rehabilitation will be asked to evaluate, recommend treatment, and/or certify the extent of disability in these cases. Our experience with the "permanently and totally disabled" welfare recipient would seem to indicate that while many may be rehabilitated physically, vocationally they are still considered "permanently and totally disabled" by business and industry.

#### Summary

The preliminary results of a pilot program to rehabilitate the "permanently and totally disabled" welfare recipient have been reported. At least 50 per cent of all patients discharged up to April 1, 1957, have made moderate to marked improvements. This proportion of improvements was noted in practically every age and disability group, with the exception of the progressive neurological diseases and in the age group past 70. The areas of improvement included self-care activities, vocational potentialities, ambulation status, and living arrangements. While these results are most encouraging, especially since the gains have been maintained in practically all patients reviewed for at least 6 months following discharge from the hospital, they cannot be considered final. In many instances difficulties in the patient's total adjustment encountered after discharge, such as in housing or employment, may nullify much of the benefit previously achieved.

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# A Method of Attempting to Prevent Increasing Paralytic Spinal Curvature in the Growing Child

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● By the application of a puller to a spinal brace some correction of paralytic spinal curvature in growing children has been obtained. Diligent care must govern the location at which the puller is attached to the brace. The location of the apex of the curve determines the position of the puller. X-ray determination of the correction obtained and the progress of the curve is mandatory. This is a stop-gap method of treatment to prevent increasing deformity and is useful only in the young growing child.

This is a preliminary report after one year's study of an attempt to prevent the increase of scoliosis in 32 children with paralytic spinal curvature in the ages of 4 to 17.

A difficult problem in the care of neuromuscular diseases is the maintenance and straightening of the paralytic spinal curvature in the growing child. The following is a description of a simple method of achieving this goal by applying an attachment to a Knight spinal brace. The device is inexpensive and easy to apply. It is worn without complaints and is of benefit to the growing child with a spinal curvature due to poliomyelitis.

This device, known as a puller, consists of a wide, heavy band of soft material reinforced by stitching with two or three straps attached at one end (see fig. 1). The other end is united to the lateral bar of the back brace on the concave side of the curve to be corrected and at the level of the apex of this same curve (see fig. 2).

The band then completely encircles the body of the patient and the straps are hooked to the buckles on the original lateral bar of the spinal brace (see fig. 3). The force that is applied to the lateral curve of the spine depends on the tension with which the straps are pulled and fastened to the buckles.

## Procedure

Before the application of the puller, all corrective deformities, such as tight iliotibial bands, hip and knee flexion contractures and leg discrepancies which influence the scoliosis, should be eliminated. An x-ray of the patient's erect spine should be taken in three different

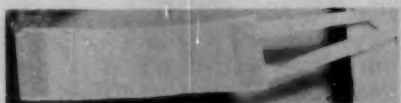


Fig. 1 — Puller for use with Knight spinal brace.



Fig. 2 — Puller attached to Knight spinal brace.

ways: (1) without any support (fig. 4), (2) with support (fig. 5), and (3) with the application of the puller (fig. 6).

The amount of traction to be applied will depend upon the correction obtained and the mobility of the spine. The straps of the puller should be marked at the buckle where they had been fastened at the time the final x-rays were taken. The family should be instructed to pull the straps up to this same mark each time the brace is applied.

For one year, 32 patients with a paralytic spinal curvature have been treated at St. Charles Hospital, Port Jefferson, New York, with the puller apparatus on a Knight spinal brace. Twenty-eight out of the 32 cases have been followed for more than six months. All of the 32 cases included in this study are poliomyelitic patients.

The puller has been used in idiopathic scoliosis with doubtful effect, and

Saint Charles Hospital.

these cases have not been included in this presentation.

Twenty-one out of the 32 patients had a 21 degree or greater curve before the puller was applied. Four had a 21 degree or greater curve after the use of the puller (see table 1).

Twenty-six of 32 patients have more than 50 per cent correction of their curves. Of these 26, 9 are 100 per cent corrected with the use of the puller (see fig. 7).



Fig. 3—Puller and brace fitted to patient.



Fig. 4—X-ray of a patient's spine without support.

Table 1: Comparative Measurement of Curve—without Appliance, with Appliance, and with Appliance and Puller Apparatus

Degree of Curve	Without Appliance No. Patients	With Brace No. Patients	With Puller No. Patients
51-55	3	1	0
46-50	0	0	0
41-45	2	0	0
36-40	2	1	0
31-35	5	3	1
26-30	6	4	2
21-25	3	5	1
16-20	6	6	3
11-15	2	6	6
5-10	3	6	10
0-4	0	0	9



Twenty-one of the 32 patients were of the age group four to ten. This represents that age group which presents the greatest problem — the young, growing paralytic poliomyelitis patient with scoliosis.

There have been no pressure sores encountered from using this apparatus. The only adjustment that has been necessary is a loosening of the puller at meal times for approximately the first week after it has been applied.

The vital capacity was taken on all the patients with and without the puller. All

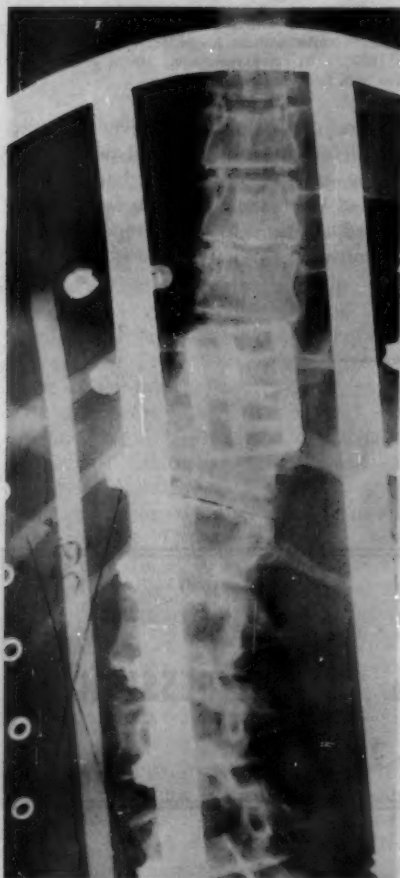


Fig. 5—X-ray of spine of patient in figure 4 supported by brace alone.

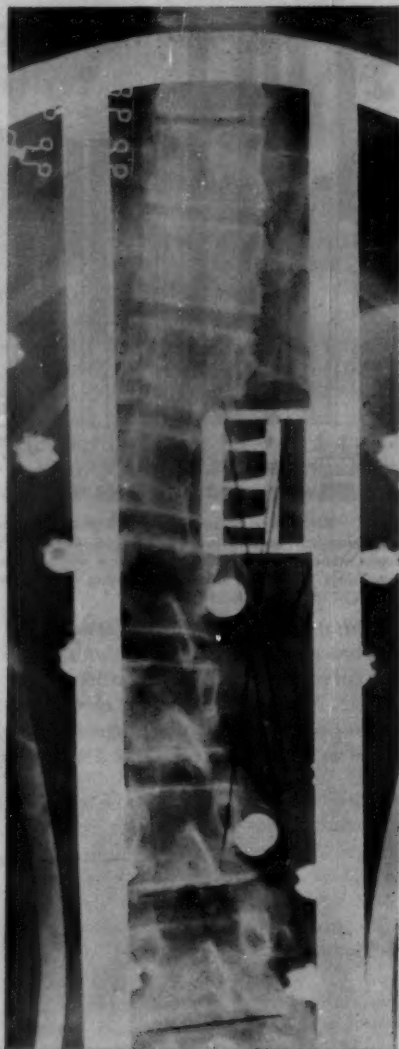


Fig. 6—X-ray of spine of patient in figures 4 and 5 supported by brace plus puller.

but four had a decrease of their vital capacity with the puller applied but in all cases this decrease was not significant.

#### Summary

By the application of a puller to a spinal brace some correction of paralytic spinal curvature in growing children has been obtained. To obtain effective correction, diligent care must govern the lo-

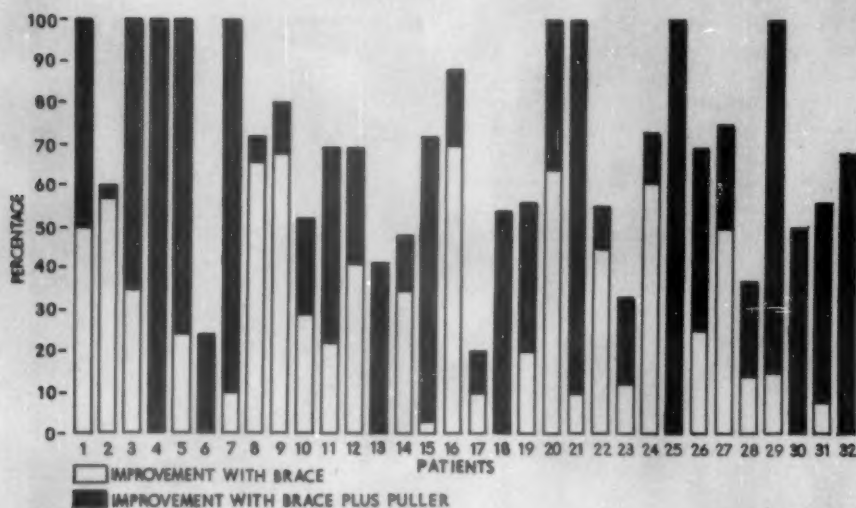


Fig. 7 — Percentage of correction with puller and brace as compared with percentage of correction with remaining = % correction with brace. Curve with puller ÷ curve without brace × 100 = % curve brace alone. Curve with brace ÷ curve without brace × 100 = % curve remaining; 100% — % curve remaining = % correction with brace and puller.

cation at which the puller is attached to the brace. The location of the apex of the curve determines the position of the puller. X-ray determination of the correction obtained and the progress of the curve is mandatory. This is a stop-gap

method of treatment to prevent increasing deformity and is useful only in the young growing child. Further observation of these same patients will be continued and a subsequent report will be submitted.

*Make your plans to be in . . .*

**PHILADELPHIA for the ANNUAL SESSION,  
AUGUST 24-29, 1958**

# Is Elastic Bracing Contraindicated in Spastics?

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• A discussion about elastic bracing and its influence on spasticity prompted a suggestion that perhaps elastic bracing did not cause an increase in spasticity. This initiated a study of 84 patients who were fitted with both Klenzak and 90° stop braces. The length of follow-up of these patients varies from two and a half years to six months. In four instances a 90° stop brace was changed to a Klenzak type of brace without increase in spasticity. The subjective and objective evaluation suggests that there is no contraindication to elastic bracing in spastic conditions such as cerebral palsy, spasticity, and old spastic hemiplegia. This is true of both children and adults. The explanation of this phenomenon is simply the adaptation.

The method of bracing for cerebral palsy and other spastic conditions is still controversial. The present study was undertaken to determine whether only a 90 degree or a fixed brace is indicated for a spastic ankle, and whether elastic bracing will increase spasticity.

## Report of a Study

Eighty-four patients were studied. These were consecutive cases referred to me. They were chosen if classified as spastics and if feasible for follow-up. The patients were followed on an average of once every three or four months. The shortest period of follow-up was nine months and the longest two and a half years. The ages varied from 3 to 75 years. The average age was 37 years. The diagnoses were as follows: 33, cerebral palsy; 31, hemiplegia; 11, paraplegia; 6, multiple sclerosis; and 3, Friedreich's ataxia.

Patients were initially examined in the usual manner. On re-examination, subjective and objective evaluation was attempted. At the beginning of this study it was not practical to do objective measurements of muscle tone, and although this would have been possible later, electromyography was not included for the sake of uniformity. It may be interesting to note that the subjective and objective findings in all cases coincided. In four patients who already were wearing a 90 degree stop brace, this was changed to the elastic type. No increase in spasticity was noted. All these cases were children who had 18 to 24 months' follow-up.

## Discussion

I had been taught that the stretch reflex is elicited by elastic bracing. This constant stimulation was thought to increase spasticity. It is known that, in the antigravity muscles, the proprioceptive nerve endings are more developed than in other muscle groups.<sup>1</sup> It follows then that the gastrocnemius and soleus, being an antigravity muscle group, will respond to stretching.<sup>2</sup> The proprioceptors are also important because a smooth, coordinated motion cannot result without appropriate afferent impulses.<sup>3</sup> The motor cortex has to be taught how to do things, but without sensory influence this is not possible and imperfect function results.<sup>4</sup>

It is easy to believe that a brace like a Klenzak, exerting pressure and stretching the Achilles tendon through its adjustable spring, would cause constant proprioceptive stimulation. This would cause facilitation and thus increase the spasticity. This in turn would make the gait worse, in which case elastic bracing would be contraindicated in spasticity. My survey did not substantiate this view; neither was it necessary to change the stop from 90 degrees to 80 degrees to prevent clonus in paraplegics.

To explain this it is necessary to point to three facts in neurophysiology: (1) The Weber-Fechner law for discrimination of sensory intensities, (2) the lengthening reaction, and (3) adaptation.

*The Weber-Fechner Law.* The Weber-Fechner law for discrimination of sensory intensities states that the number of impulses is approximately proportional to the logarithm of the intensity of the stimulus.<sup>5</sup> For example, increasing a pain stimulus from minimal value to 100 times the minimal might increase the

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number of stimuli in the nerve fiber from zero to 5 stimuli per second. Then, increasing the intensity from 100 to 10,000 would increase the number of sensory nerve impulses only from 5 per second to 10 per second, and so on. The logarithmic response of sensory receptors holds for most modalities of sensation, at least within the range of normal intensities.

*The Lengthening Reaction.* The lengthening reaction is a special adaptation of the stretch reflex. It serves for muscle protection. This lengthening reaction can be elicited especially well in animals that are spastic because of excess numbers of facilitative impulses arriving in the spinal cord from the central nervous system.<sup>6</sup> Perhaps the muscle spindles are responsible mainly for resistance to instantaneous stretch, while other receptors, the Golgi tendon apparatus for instance, perceive the excess stretch on the muscle and cause the lengthening reaction.

*Adaptation.* There is always some stimulation such as pressure or heat and if these would constantly stimulate the various receptors, the brain would be harassed with so many impulses that it could not interpret them properly. All types of receptors adapt, that is, they gradually respond less strongly to a repeated stimulus. There is a different degree of adaptation of different types of receptors.<sup>7</sup> The fastest rate of adaptation is light touch, next is pressure, temperature, burning and proprioception and, therefore, the proprioceptive adaptation in some instances may require several days to occur.

As the Achilles tendon is stretched by the spring in the Klenzak joint, there is pressure on the sole of the foot and under the posterior calf band of the short leg brace. These afferent stimuli eventually cease to be registered so that the facilitation and the increase in spasticity is eliminated. This is probably effected through the three processes mentioned, as well as through other facilities of the nervous system.

#### Summary

Eighty-four patients with spasticity were subjected to elastic type of bracing. They were followed from 9 to 30 months. No increase in spasticity was found that could be attributed to this type of bracing. This is explained on the basis of the Weber-Fechner law for discrimination of sensory intensities, the lengthening reaction, and adaptation.

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# Bacterial Resistance to Ultraviolet Irradiation

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and  
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● Complete kills of accessible bacteria due to ultraviolet irradiation were obtained in successively irradiated survivors of colonies of *M. pyogenes* var. *aureus* well within therapeutic limits to which human tissue tolerance can be readily induced. With the light source and conditions employed, there was no photoresistance nor were any mutations induced when increasing exposures of "far" ultraviolet irradiation up to the point of a complete kill were employed.

This study is the second in a series made to determine differences in morphology, staining characteristics, biochemical reactions, pathogenicity, and photoresistance of bacteria never subjected to ultraviolet irradiation, as compared with survivor colonies of the same bacteria which had been successively irradiated up to the point of a complete kill in each instance. We performed no studies in this investigation relative to changes in the protein structure of those organisms killed by ultraviolet irradiation.

It is generally recognized that practically all bacteria can be killed by adequate ultraviolet irradiation, using either "near" or "far" sources of ultraviolet energy. Those organisms which normally invade the human body are usually the most susceptible to ultraviolet irradiation, including those strains which may be highly resistant to the known antibiotic drugs. The difficulty of exposing such invaders to adequate ultraviolet irradiation stems from the fact that deep penetration of ultraviolet energy through living tissue is normally not great either in the very short wave lengths (for example, 2,537 Å) or in the middle ultraviolet range (2,900-3,100 Å), being in either case not more than 1-2 mm. More effective penetration can often be obtained by dehematization or "ironing out" of the tissues by pressure, using quartz plates.

The factors influencing ultraviolet irradiation upon an organism or person are:

1. Susceptibility of the organism or person.

2. The particular spectral energy distribution of the source.
3. Intensity (expressed in MW/cm<sup>2</sup> of the area).
4. Duration of the exposure.

## Procedure

The source of ultraviolet irradiation for this experiment was the Fischer Model "CK" ultraviolet generator. The quartz burner, producing emanations in the 2,537 Å band, the so-called bactericidal spectrum, was employed. A fixed operating distance of 30 inches from front of burner to surface of media was maintained. No filters were used.

As in a prior experiment,<sup>1</sup> in which the only variant was the type of ultraviolet generator, a stock strain of hemolytic micrococcus pyogenes var. aureus was uniformly streaked on blood agar medium, irradiated for 60 seconds, and incubated in the dark. The process was repeated with survivors of each succeeding irradiation. As the irradiation time was successively increased, survivors of each preceding irradiation were used as subjects for each succeeding irradiation, while nonirradiated parent organisms were used as the control in each instance. The bilateral series was continued until an exposure time was reached which produced a complete and consistent kill in both the successively irradiated survivor organisms and the parent control group.

Using laboratory animals of the same litter, weight, and age, suspensions of

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This study was reviewed and published with the approval of the Chief Medical Director, Veterans Administration. The statements and conclusions published by the authors are the result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

measured volume and dilution of cultures of irradiation survivors were injected intraperitoneally. This was done serially for each irradiation time. No appreciable difference in reactions was observed at autopsy in these animals as compared with the reactions found in similar control animals inoculated with the parent culture of the same organism, never subjected to ultraviolet irradiation.

With the irradiation source employed by us (2,537 Å), we did not find that *M. pyogenes* var. *aureus* exhibited induced resistance to penicillin and streptomycin following ultraviolet irradiation, or growth in irradiated substrate. This negative finding is at variance with the conclusions drawn by Haas, Wyss, Berger, and Stone.<sup>2</sup> Our experiments indicated that irradiation of substrate by both natural and artificial means had no residual effect on the growth potentialities of *M. pyogenes* var. *aureus* when streaked immediately following irradiation of the substrate, nor after one-half hour, at which time any incident ozone and hydrogen peroxide effect would be negligible. Induction of mutations in such colonies, due to growth on irradiated substrate, was not observed.

Kelner<sup>3</sup> has found that in a population of microbial cells irradiated with ultraviolet light (2,537 Å), a large portion of the cells are inactivated before dying, but that if such cells are illuminated with visible light within a certain time, many of these cells are reactivated and can divide apparently normally and form a colony. Using as nearly as possible the procedure described by Kelner, and taking extreme precautions so that all conditions applying to the controls before and after irradiation would be the same as those applying to the illuminated cultures, with the exception of postirradiation illumination with visible

light, we illuminated a series of test cultures for periods varying from 1 to 30 minutes following ultraviolet irradiation and prior to incubation. In no case was incubation delayed more than 30 minutes following ultraviolet irradiation. The phenomenon of photoreactivation, as described by Kelner,<sup>3</sup> was not observed in our series.

#### Summary

Complete kills of accessible bacteria due to ultraviolet irradiation were obtained in successively irradiated survivors colonies of *M. pyogenes* var. *aureus* well within therapeutic limits to which human tissue tolerance can be induced readily. With the light source and conditions employed, there was no photoresistance nor were any mutations induced when increasing exposures of "far" ultraviolet irradiation up to the point of a complete kill were employed. This paper is essentially a repetition of a similar experiment in which the light source employed was in the "near" ultraviolet portion of the electromagnetic spectrum (2,900-3,100 Å), and as a result of which similar conclusions were drawn with respect to bacterial photoresistance, changes in morphology, staining characteristics, biochemical reactions, and pathogenicity following ultraviolet irradiation of *M. pyogenes* var. *aureus*.

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## abstracts

**The Serum Transaminase Test in Various Diseases. Its Diagnostic Value in Liver Disease.** Robert Watanabe; Albert A. Kattus, and Charles Semenson. *J. Chron. Dis.* 6:561 (Dec.) 1957.

Serum glutamic-oxaloacetic transaminase levels in 111 patients with various diseases were studied. The authors found slight elevations in rheumatic pericarditis, pulmonary infarctions, quiescent non-icteric cirrhosis of the liver, chronic lymphatic leukemia, one cerebrovascular accident, scleroderma, shock, diverticulitis of the colon, probable renal infarction, postoperative patients, and one new born infant. Marked elevations were found with severe idiopathic pericarditis, preterminal shock and cyanosis, acute pancreatitis, viral hepatitis, obstructive jaundice, cirrhosis of the liver with jaundice, metastatic cancer of the liver, muscular dystrophy, paroxysmal myoglobinuria, infarcts of kidney and brain, and one postoperative patient. In view of the significant increases in serum transaminase with cell destruction in a variety of diseases, its use as a diagnostic tool for differentiating various acute processes is questionable. The use of serial studies demonstrating the course of transaminase with time may be of diagnostic value.

**Effect of Posture on Strength of the Knee Flexor and Extensor Muscles.** S. J. Houtz; M. J. Lebow, and F. R. Beyer. *J. Appl. Physiol.* 2:475 (Nov.) 1957.

A muscle dynamometer with a versatile supporting apparatus is described and used for studying the effects of posture on the strength of knee flexor and extensor muscles. Isometric maximal effort tests in seven positions through a range of knee motion were performed by normal females in the sitting, supine, and prone postures. The force developed by flexor and extensor muscle groups varies with the position of the knee and hip, extension being greatest between 90° and 120° depending on the position, and flexion generally being greatest at near full extension where the force of the flexors and extensors was about equal. In all other positions the extensors were superior in strength. The posture of the subject has a greater effect on the realizable force developed at the knees than does the influence of gravity on the leg,

or the stabilization of adjacent parts. The authors concluded that some factor other than the mechanical advantage influenced the strength curve. They suggested, when seated, the subject was in a better position to use facilitatory effects of the extensor thrust and flexion reflex mechanism. Other possibilities were also discussed.

**Evaluation and Management of the Brain Damaged Patient.** Jerome S. Tobis; Milton Lowenthal, and Simon Maringer. *J.A.M.A.* 165:2035 (Dec. 21) 1957.

Clearly crystallized is the total plan necessary in the care of the brain damaged patient. The brain damage definition is extended to include the sensory, motor, and organic mental damage areas for it is typical to find damage to overlap more than one area. Evaluation of the patient must include in addition to the neurologic examination, functional neuromuscular performance in the activities of daily living and evaluation of psychologic and emotional capabilities. Important features to consider in each of these three areas of evaluation are discussed in terms of their importance in the diagnosis of the patient's total residual capacity. The rehabilitation of the brain damaged patient is presented in terms of improvement of musculoskeletal and psychological function.

**Observations on the Examination of Children's Feet.** Walter R. Miller. *J. Pediat.* 51:527 (Nov.) 1957.

Major deformities seen in children's feet and their treatment are detailed. Miller points out that absence of the longitudinal arch before 30 months is normal, and raises the question whether metatarsus varus as an isolated finding requires treatment, since the condition is rarely seen in adults. The major portion of the discussion centers on calcaneovalgus deformities with pronation (valgus) of the forefoot, internal or external foot rotation, metatarsus varus, and clubfeet.

He condemns the use of arch supports (arch cookies), lateral sole wedges with medial heel wedges, poorly fitted shoes (including those with uppers too low to be effective),

Whitman's steel plates, and operations on the mid-tarsal portion of the foot. In place of these, he presents a relatively detailed, logically developed approach to each of the deformities aimed toward maximal correction, function, and comfort. Each program is outlined in sufficient detail that the paper will be a guide to management of the majority of problems seen by a physician dealing with deformities of the feet in young children.

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**The Neck-Righting Reflex in Children.** Robert L. Spitzer; Yale Kramer, and Richard Babkin. *J. Pediat.* 52:149 (Feb.) 1958.

One hundred children were examined while supine by grasping the child's head at the temples, gently turning it first 90° to one side, then 90° to the other side, holding the head for a minimum of five seconds in each position. The response was considered positive if, within five seconds after the head was thus turned, the child turned his trunk in the same direction. Partial turning was recorded as questionable. All other responses were considered negative.

In this series six per cent showed positive and eight per cent showed questionable responses. An earlier report by Schaltenbrand gave 68 per cent positive, 20 per cent questionable. Thus, although the neck-righting reflex has been demonstrated in infra-human mammals, and it has been described as a normal reflex in infants and children, the present report indicates that this should be investigated more widely under controlled circumstances to establish whether it is, then, part of the normal "reflex" system or only represents struggling, as is here suggested.

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**Ascorbic Acid Metabolism and Rheumatoid Arthritis.** J. H. Glyn, and E. J. Moran Campbell. *Ann. Phys. Med.* 4:139 (Nov.) 1957.

Inspired by a case of scurvy referred to their physical medicine clinic as a case of osteoarthritis of the knees, the authors discuss some of the features of scurvy which might be mistaken for rheumatoid arthritis such as pain, effusion, or hemarthrosis in the knee. They review the papers of McCormick, who in 1955 expressed the opinion that ascorbic acid deficiency caused rheumatoid arthritis, and of other authors who disagreed. They briefly discuss ascorbic acid and connective tissue metabolism. Ascorbic acid deficiency is characterized by a failure of the fibroblast, osteoblast and odontoblast and an inability of the supporting tissues to produce and maintain the intracellular substances. The

physiologic chemistry of these systems is alluded to, but might have been discussed in greater detail. In discussion of this case of rheumatism due to scurvy, they emphasize the necessity to replenish the ascorbic acid stores in the body until eight-hour urinary excretion of ascorbic acid reaches normal.

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**Effects of Induced Hyperthermia on Some Neurological Diseases.** Dewey A. Nelson; William H. Jeffreys, and Fletcher McDowell. *A.M.A. Arch. Neurol. & Psychiat.* 79:31 (Jan.) 1958.

One hundred subjects were studied for the effects of systemic heating on the nervous system. Sixteen normal subjects, 12 patients with multiple sclerosis, and 72 patients with other neurological diseases made up the group. Immersion in hot water at temperatures from 104 to 110 F. was used to produce hyperthermia. Fifty-two of the 84 patients showed definite neurological changes and these are analyzed under the headings of oculomotor, visual, reflex, strength, and seizures. The patients with multiple sclerosis are discussed as a group. All patients with multiple sclerosis showed neurological changes which appeared at lower temperatures on the average than in patients with other neurological diseases.

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**Steroid Therapy.** J. H. Glyn, and D. R. L. Newton. *Ann. Phys. Med.* 4:121 (Nov.) 1957.

Systemic therapy in rheumatoid disease was reviewed, covering many individual clinician experiences and controlled studies by such groups as the Empire Rheumatism Council and the Medical Research Council. In several two-year studies no significant therapeutic differences were noted between salicylates in high dosages and the steroids. Major undesirable side effect developed in 60 per cent of 432 patients in a retrospective study by the American Rheumatism Association.

ACTH, hydrocortisone and cortisone derivatives were briefly discussed. Prednisone and prednisolone were covered in some detail. The latter two drugs were felt to be the most useful of the corticosteroids because of the significantly less sodium retention, potassium loss, and mental aberrations incurred through their usage.

The authors describe the generally accepted principles of treatment, controversial principles and the Mayo Clinic scheme. It was generally agreed that the corticosteroids were valuable drugs in the treatment of rheumatoid arthritis if maintenance doses were not of such levels as to cause the major undesirable side effects.



It was also emphasized that once cortisone was started it was essential that the drugs be continued for as long a period of time as was proved necessary.

**Sensory Disturbances in the Hands of Children with Cerebral Palsy.** Mihran O. Tachdjian, and William L. Minear. *J. Bone & Joint Surg.* 40-A:85 (Jan.) 1958.

A report is made on the evaluation of 96 children with cerebral palsy using a variety of modalities to study sensory disturbances, as well as comparing relative size of the involved extremities with uninvolved, and skin temperatures. Sixty-four children had spastic hemiplegia, 24 had spastic quadriplegia, seven had athetoid quadriplegia and one had athetoid hemiplegia. Sensory disorders were found in 40 children, the modalities of stereognosis, two point discrimination, and position sense being most often involved. Skin temperatures were equal bilaterally in 91 patients in spite of the fact that all showed some degree of underdevelopment of the involved upper extremity. The authors point to this as evidence that disuse atrophy is the cause of the difference in growth. It should be noted, however, that skin temperature is not a good guide to total circulation in an extremity, and they do not indicate what control, if any, is used regarding room temperature and humidity which might change the picture greatly. The discussion of practical significance points out the poor functional result following surgery when it is performed on extremities where there is sensory impairment.

**Cutaneous Respiration in Man.** Laurence R. Fitzgerald. *Physiol. Rev.* 37:325 (July) 1957.

Fitzgerald discusses the various findings on cutaneous transfer of oxygen and carbon dioxide presented in the literature to date, appraising the methods of sampling and of analysis. He points out that skin temperature changes create major alterations in "respiratory rate," but most studies have recorded only room or chamber temperature, often without regard to the relative humidity. After a critical analysis of techniques formerly used, he suggests a method of sampling small areas and recording skin temperature for future studies on the subject.

Evidence cited indicates that the oxygen diffusing into the skin is utilized in the epidermis. He suggests that it may represent a significant amount of the total oxygen supply to the epidermis. Carbon dioxide given off appears to be both from cutaneous respiration and from cutaneous blood.

In conclusion, the author points out a number of studies as yet undone which could offer significant advances in our understanding of metabolic processes in the skin, including the effects of surgical dressings on wound healing, cosmetics interfering with cutaneous respiration, and the effects of organic disease.

**Nutritional and Biochemical Effects of 19-Nortestosterone with Lysine Supplements in Aging Convalescence.** A. A. Albanese; R. A. Higgins; L. A. Orto; D. N. Zavattaro, and J. Breitenbach. *Geriatrics* 13:7 (Jan.) 1958.

In a previous report the authors induced significant improvement in the nitrogen balance of 50 per cent of a series of 64 adults through the administration of lysine supplements. Failure of positive nutritional response of certain individuals prompted them to consider the use of a steroid of high anabolic and low androgenic characteristics such as 19-nortestosterone. Twenty-five, 50 and 75 mg. of 19-nortestosterone per day were used on convalescent males ages 54 to 85. Seven hundred and fifty mg. of L-lysine along with 75 mg. of 19-nortestosterone were used in seven other adult male convalescents. Results indicated that there was an improved nitrogen retention with the use of 19-nortestosterone and lysine over that of lysine alone.

**Serum Proteins in Chronic Diseases of Different Etiologies.** E. J. Chesrow; G. C. Turner; F. Schaffner, and J. Musci. *Geriatrics* 12:642 (Nov.) 1957.

Electrophoretic separations of serum proteins, lipoproteins, and glycoproteins were made in 91 chronically ill patients — 47 with multiple sclerosis, 24 with advanced pulmonary tuberculosis, 12 with advanced generalized arteriosclerosis, and eight with severe rheumatoid arthritis. Twenty-four normal controls consisted of laboratory and office personnel. The mean gamma globulin fraction was significantly increased in all the diseases studied with the greatest average increase in the tuberculosis and rheumatoid arthritis groups. The carbohydrate bound to the gamma globulin fraction was found to be decreased in the disease groups. No significant differences were found between patients and controls in protein, carbohydrate, or lipid content of the other serum protein fractions. The increase in gamma globulin in rheumatoid arthritis and tuberculosis as a reflection of the inflammation associated with these diseases is explained. The elevation in the multiple sclerosis patients was considered to be chiefly a result of chronic urinary tract infection

which was almost always present. Malnutrition, particularly undernutrition, was considered the cause of the increased gamma globulin in the aged arteriosclerotic group.

No information of the food intake and actual nutritional status of the patients is given. It is reasonable to infer that malnutrition may be a problem in all chronically ill patients regardless of the disease. It is concluded that the changes in gamma globulin noted are caused by debility, intercurrent infection, poor appetite, and malnutrition which are non-specific factors common to most chronic illnesses.

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**Congenital Absence of the Fibula.** T. Campbell Thompson; Lee Ramsay Straub, and William D. Arnold. *J. Bone & Joint Surg.* 39-A:1229 (Dec.) 1957.

The findings in 31 instances of congenital absence of the fibula occurring in 25 patients observed and treated between 1939 and 1955 are listed. The association of absence of the fibula with gross shortening of the involved extremity which frequently appears in the femur also, talipes equinovarus, absence or partial absence of the fibula, medial or anterior bowing of the tibia, tarsal anomalies, absence of metatarsal rays, and other anomalies is presented.

A tight band of fibrous or fibrocartilaginous tissue in the location which the fibula would have occupied had it been present in eighteen extremities was found, leading to the assumption that it represents the anlage of the absent fibula. More satisfactory correction of deformities when the band has been dissected and excised is reported. Advisability of a Symes amputation to allow correction of the gross disparity in leg length, a matter of several centimeters, after completion of growth is discussed. In closing, the co-workers state that the effectiveness of surgery is increased by early removal of the deforming factor.

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**New Drugs for Hypertension with Special Reference to Chlorothiazide.** Robert W. Wilkins. *New England J. Med.* 257:1026 (Nov. 21) 1957.

Wilkins' clinical experience in the use of veratrum, Rauwolfia, hydralazine, ganglionic blocking agents, antiserotonins and the diuretic agents in the control of hypertension is detailed. The practical approach of value to the general physician is used. The major conclusions are: 1) Veratrum is limited by the close combination of emetic and hypotensive effects. The discovery of protoveratrine A and B has not resulted in greater usefulness of this drug. 2) Reserpine is still the

chief active principle in Rauwolfia. Up to three months of continuous treatment is needed for the full hypotensive effect. A dose greater than 1 mg./day is no more effective.

3) Hydralazine is the only drug with direct renal vasodilator action. It is well tolerated in combination with reserpine in low dosages. 4) Ganglionic blockers all have the problem of dosage variation within the same patient. Development of patient resistance and the side effects of autonomic blockade restrict its usefulness. It should be postponed for use as a last resort in benign non-progressive hypertension. 5) The antiserotonin, BAS (benzyl analogue of serotonin), acts like reserpine. Although clinically useful in hypertension its most striking action is one of sedation or tranquilization. 6) The diuretic agents, namely chlorothiazide, have a hypotensive as well as a diuretic effect. They are very useful as an adjunct in therapy. The effect varies with the state of hydration and salt content of the body. These agents are the most promising in the author's opinion. Clinical data on its use are presented.

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**Cross Education in the Prosthetic Training of the Below Elbow Amputee.** F. A. Hellebrandt; S. J. Houtz, and M. J. Partridge. *Am. J. Phys. Med.* 36:196 (Aug.) 1957.

Twenty-two adults were trained and tested, 20 of whom were occupational or physical therapists, in the use of the voluntary opening Dorrance utility hook activated by ipsilateral flexion or contralateral shoulder shrug. The Minnesota Rate of Manipulation test was used for standard activity. Pre-training tests of manipulation were given to each hand and with the prosthetic device on each upper extremity. After the tests the subjects were arbitrarily assigned to train one hand (one upper extremity in the use of the device) and subsequently they were tested again on the trained and the untrained sides. Also tested was a girl with a congenitally absent hand—testing her normal hand and also testing her arm with its new prosthesis and the Dorrance utility hook. Her movement patterns were studied electromyographically. In 10 days speed and skill had developed approximately twice that at the initial test on the trained side. Cross education did occur since the untrained side was 50 per cent faster than it was initially. It was thought that this was not due to overt mimicry of the other side since in the placing test it was necessary to reach for the object. To do this, the contralateral shoulder and arm had to move in the opposite direction which would appear to prevent mimicry.

The subjects tired very quickly while using the mock up. Because of this it is suggested that endurance training would be more im-

portant in preparing the patient for use of this type of prosthesis than either strengthening or coordination activities. This raises the possibility that the improvement of skill by the contralateral side was due to an increase in endurance.

**Treatment of Iron Deficiency Anemia in the Adult.** G. Pirzio-Biroli, and Clement A. Finch. *J. Chron. Dis.* 6:302 (Oct.) 1957.

Iron deficiency anemia of adults is, except in rare cases, a blood loss anemia. In support of this thesis the authors point out that iron excretion is 0.5 to 1 mg. per day, that iron reserves of some 1200 mg. exist in the body for rapid replacement, and that daily absorption of dietary iron in the iron deficient subject amounts to 3 to 4 mg.

They propose routine treatment with oral ferrous salts for three weeks (0.2 gm. exsiccated ferrous sulfate or 0.3 gm. ferrous gluconate 3 times daily) or one injection of intramuscular iron dextran (100-500 mg.). With either preparation, hemoglobin should increase 0.2 gm. per 100 cc. per day after the first three or four days. Reticulocytosis is not sufficiently pronounced to be relied upon as an index of response. Failure of the patient to respond in three weeks means further search for the cause of anemia is indicated. Treatment with oral iron may be discontinued two to three weeks after hemoglobin reaches a normal level. When parenteral iron is used, the dose may be calculated to replace the deficit. The necessity for establishing the site of blood loss as well as treating anemia in iron deficient adults is stressed.

**The Acute Calcification of Traumatized Muscle, with Particular Reference to Acute Post-Traumatic Renal Insufficiency.** W. H. Meroney; G. K. Arney; W. E. Segar, and H. H. Balch. *J. Clin. Invest.* 36:825 (Feb.) 1957.

In acute post-traumatic renal insufficiency, hypocalcemia, hyperphosphatemia, and hyperpotassemia result. The more extensive the muscle devitalization the more extreme are these electrolyte disturbances. Infused intravenous calcium given to antagonize the toxic effects of the hyperpotassemia is known to escape rapidly from the plasma. The purpose of this paper is to examine the possibility that the calcium is deposited in damaged muscle tissue.

Using radioactive technics on traumatized and nephrectomized dogs, the authors demonstrated that within six hours after trauma, the calcium content of the damaged dog muscle doubled and that the quantity of calcium deposited in damaged muscle in

nephrectomized dogs increased more than tenfold. The calcium content in undamaged muscle was not altered by trauma elsewhere to the body nor was it affected by nephrectomy. A direct exchange between tissue magnesium and plasma calcium is offered as the mechanism involved in the calcium deposition.

**Atherosclerotic Gangrene of the Lower Extremities in Diabetic and Nondiabetic Persons.** E. T. Bell. *Am. J. Clin. Path.* 28:27 (July) 1957.

In an autopsy study of 50,184 nondiabetic and 1,878 diabetic persons who were more than 40 years of age at death, 186 instances of atherosclerotic gangrene (in one or both lower extremities) were found in the nondiabetic and 393 instances in the diabetic patients. Gangrene was 53 times more frequent in diabetic than in nondiabetic men over the age of 40, and 71 times more frequent in diabetic than in nondiabetic women of corresponding age. Two-thirds of the cases of gangrene in men less than 80 years of age were the result of diabetes. Approximately 80 per cent of gangrene in women was caused by diabetes.

There was no relationship between the development of gangrene and either the insulin requirement or the known duration of the diabetes. Gangrene was unilateral in 74 per cent of the diabetic and 79 per cent of the nondiabetic patients. Infection appeared to play a major role in diabetic gangrene but was of minor importance in nondiabetic gangrene. The average period of survival after amputation was longer in diabetics than nondiabetics. This appeared to be a reflection of a lesser degree of vascular obstruction in diabetics. Hyalinization of the juxtaglomerular segment of the afferent arteriole was found in 87 per cent of the diabetics but in only 10 per cent of the nondiabetics. The author suggests that advanced hyalinization in this area as well as capillary glomerulosclerosis and hyaline islets in the pancreas may indicate either frank diabetes or a prediabetic state.

**Biophysics and Physiology of the Inner Ear.** Hallowell Davis. *Physiol. Rev.* 37:1 (Jan.) 1957.

Of particular interest in this article are the descriptions of the movements of the cochlear basilar membrane, organ of Corti and tectorial membrane, and the electrical phenomena of the cochlea as related to them. From this Davis develops the electrical mediator theory of excitation of the auditory nerve. In the summary the author discusses the "duplex" theory of frequency discrimination involving both the "volley" principle and the

"place" principle. He then progresses to pertinent unanswered problems which would, if answered, assist in establishing a description of the process whereby subatomic amplitudes of input can be translated into impulses as they are known in the auditory nerve.

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**Benign Tumors of Peripheral Nerves and Their Masquerade.** Henry W. Dodge, Jr., and Winchell McK. Craig. *Minnesota Med.* 40:294 (May) 1957.

The authors review 343 solitary benign tumors of the sheaths of peripheral nerves removed surgically at Mayo Clinic between 1909 and 1948. Of these, 14 patients had treatment for local recurrences. At least two died from sarcoma developing at the site of previous operation. Most of these tumors had existed for long periods of time prior to discovery and removal, although many were palpable masses. Several interesting case histories demonstrating the close approximation of symptoms to other syndromes, e.g. "disc," angina pectoris, renal colic and Bell's Palsy are presented.

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**Treatment of Burns in Elderly Patients.** T. G. Blocker. *Geriatrics* 12:457 (Aug.) 1957.

This article is a report of the experience gained from 728 patients hospitalized for primary burn therapy during the past six years. Only 42 or 5.7 per cent were 60 years of age or over. Of the 67 deaths (9.2 per cent) 10 occurred in elderly individuals. Not one patient in the older age group survived burns of 30 per cent or more and four of the 10 deaths occurred in patients with less than 30 per cent burn.

Deaths in the elderly are related chiefly to the extent of burn and occur within the first few days from shock and delayed therapy or later from infectious complications. Some succumb to pneumonitis or cardiovascular sequelae.

Treatment must take into account the accompanying physical and mental deterioration of aging; the debilitating effects of prolonged bed rest; the burn area as a source of infection; and degenerative changes in the skin itself which may result in deep initial involvement and curtailment of repeated use of donor sites for skin coverage.

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**Some Current Concepts of the Etiology of Rheumatoid Arthritis.** Ellis Dresner. *J. Chron. Dis.* 5:612 (June) 1957.

Three concepts of the etiology of rheumatoid arthritis — adrenocortical dysfunction, disordered metabolism due to hepatic dysfunction, and hypersensitivity are discussed. Each of these theories lacks sufficient scientific evidence to make it generally acceptable. At the present time, however, they appear to be the most logical concepts. The author also discusses the relation between the sensitized sheep cell agglutination test and its specificity for the adult and juvenile forms of rheumatoid arthritis. Dresner feels the answer to this perplexing problem will come only through combined study of people ill with rheumatoid arthritis and study of structure and function of the connective tissues.

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**Chronic "Benign Aseptic Meningitis."** K. D. Bagshawe; E. W. Smith, and I. L. Bennett. *J. Chron. Dis.* 6:120 (Aug.) 1957.

This study is a summarization of the histories of six cases of aseptic meningitis running prolonged courses in which the etiologic agents were not identified. In two instances there was a transiently positive complement fixation test for syphilis in the spinal fluid, and in one the blood serological test for syphilis was also positive. Several patients suffered recurrences or relapses, one having four recurrences over a period of eight years. Abnormal spinal fluid findings persisted several months to more than one year following apparent clinical recovery. Because of the similarity of these cases to those reported by other workers in which lymphocytic choriomeningitis was implicated by virus isolation or antibody titer, the authors feel these patients represent lymphocytic choriomeningitis with chronic or intermittent manifestations. They suggest that prolonged abnormality of spinal fluid findings should be regarded as a warning of the liability of meningitic relapse. They state there is no evidence that such findings, associated with relapses or not, carry a less favorable long-term prognosis than the acute forms of aseptic meningitis.

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**The Transplacental Transmission of Poliomyelitis.** Percy Barsky, and A. J. Beale. *J. Pediat.* 51:207 (Aug.) 1957.

This is a report on six infants born to mothers suffering from the acute phase of poliomyelitis. Poliomyelitis virus type 1 was isolated from the stools of three stillborn infants. There was no gross or pathologic evidence of poliomyelitis on fetal autopsy. The other three infants had a normal delivery and remained alive and well. No virus was isolated from their stools. No virus could be isolated from



the cord blood of any of the six infants. The finding of virus in the meconium of the still-born infants of mothers with poliomyelitis is presumptive evidence of intrauterine infection by transplacental transmission since the possibility of contamination of the meconium with virus appears unlikely. The findings also give support to the concept that viremia is a phase in the pathogenesis of poliomyelitis.

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**Procyclidine Hydrochloride (Kemadrin)**  
**Treatment of Parkinsonism.** Adolfo Zier,  
and Lewis J. Doshay. *Neurology* 7:485  
(July) 1957.

Procyclidine Hydrochloride was first studied and synthesized in England and introduced in the United States in 1953. It is a spasmolytic atropine-like drug related chemically and pharmacologically to Artane. Zier and Doshay studied its effect on 108 patients with Parkinson's Disease and eight non-parkinsonian dyskinesias, either alone or in combination with other drugs. The dose was started at 2.5 mg. t.i.d. and built up to tolerance. The average dose was 10 mg. t.i.d. in young adults and 5 mg. t.i.d. in the older patients.

Improvement was based on evaluation of performance in activities of daily living and on clinical examination. If any one of the cardinal symptoms of paralysis agitans was improved for at least one month, the drug was considered beneficial. On this basis 57 per cent of the patients showed improvement, the arteriosclerotic type more so than the postencephalitic. Rigidity, tremor and general well being were the areas most often improved but like other medications the beneficial effects wore off with prolonged use. Cogentin in cases of severe rigidity, and Parsidol in those of marked tremor are advised as adjunctive therapy.

Dryness, blurring of vision and giddiness were the major side reactions and in no case was there any confusion or mental aberrations. These effects diminished with continued use. In conclusion, Procyclidine Hydrochloride is considered a valuable addition to the armamentarium for paralysis agitans.

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**Tetanus. General Considerations on 1,047 Cases Admitted to the Hospital das Clinicas de Sao Paulo.** Dacio Pinheiro. *J. Pediat.* 51:171 (Aug.) 1957.

Pathogenesis of tetanus is reviewed and a treatment regimen which has proved successful is described. The tetanus toxin is water-soluble and composed of two fractions — tetanolysin, which has no clinical significance, and tetanospasmin, which probably reaches the central nervous system by propagation along nervous pathways. When

it becomes fixed to the ganglionic cells of the anterior horns of the medulla it renders the nervous system extremely sensitive to the slightest stimuli. The muscular hypertonia is produced by peripheral action of the toxin on the myoneural junction. The highest mortality rate was observed in the group with the shortest incubation time and the shortest "onset time" (time between the first symptom and first spasm). Prognosis is always grave since world wide mortality rates are still 40 to 50 per cent.

Treatment consists of sedation and relaxation with mephenesin, serotherapy to neutralize and prevent new doses of toxin from reaching the central nervous system, debridement of the focus of infection to stop production of toxin, and symptomatic care. The author stresses the value of around the clock vigilance in the event that emergency measures such as tracheotomy are required.

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**Some Aspects of Cervical Spondylosis.**  
**Peter Bradshaw.** *Quart. J. Med.* 26:177  
(Apr.) 1957.

The clinical features of 72 patients (57 men and 15 women) with cervical spondylosis and resultant myelopathy or radiculopathy are presented, analyzed and discussed. The age range at onset of symptoms was 28 to 66 years.

Bradshaw points out that myelographic demonstration of cervical spondylosis is no assurance that existing neurological deficit is a result of the spondylosis. In six of the patients the cause of the symptoms proved to be some other disorder.

The chief myelographic findings were a posterior filling defect due to thickening and plication of the ligamentum flavum; broadening of the normal ribbon of translucency because of slight pressure on the anterior surface of the cord; an anterior indentation from displacement of a previous soft nuclear herniation by the posterior longitudinal ligament. The protein level in the lumbar cerebrospinal fluid was sometimes as high as 120 mg. per 100 ml. in the absence of a manometric abnormality.

Evidence presented suggested that focal spondylosis arises from a traumatic nuclear herniation. However, there was progressive myelopathy after trauma due to spondylosis without associated herniation. Occupational stress did not predispose to cervical spondylosis but where spondylosis already existed, it appeared to increase liability to neurological complications.

Patients with focal spondylosis tended to improve when treated with supportive collars. Those with generalized spondylosis most often deteriorated. The majority of those with brachialgia obtained complete relief within weeks of assuming a collar.

Although short term results after surgery were satisfactory about half the patients with myelopathy deteriorated within six to 18 months. It is postulated that the cause of this deterioration was arachnoiditis.

The pathogenesis of the myelopathy associated with spondylosis remains in doubt and is seldom related to direct cord compression. It is suggested that one of the three main radicular arteries which contribute to the anterior spinal artery may be compressed by osteophytes or adhesions and so produce cord ischemia.

It is interesting to note that 65 per cent of people over the age of 50 have such spondylosis without neurological symptoms or signs.

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**Observation on the Topography of the Lateral Column of the Human Cervical Spinal Cord.** Marion C. Smith. *Brain* 80:263 (Part II) 1957.

The changing relations of the largest group of fibers in the lateral column of the cervical cord were studied by histological examination. The material was obtained from patients who had pain relieving operations on the lateral columns and others who had pathologic or accidental lesions of the cord or of the brain. The anatomical relationships between the pyramidal, spino-thalamic and spino-cerebellar tracts are discussed, demonstrating three main patterns of distribution.

Between C8 and C5 the posterior and anterior spino-cerebellar tracts form a continuous band along the periphery, from the posterior horn to the level of the most lateral of the anterior nerve roots. The posterior spino-cerebellar fibers lie posterior to the level of the central canal. Medial to this posterior group lie the pyramidal fibers, and medial to the anterior spino-cerebellar tract lies the spino-thalamic tract.

In C4 and C3 the spino-cerebellar fibers are massed more closely, extend less posteriorly, and along with the spino-thalamic tract become more medial. The cortico-spinal fibers come to the surface in this region to

occupy the area anterior to the posterior horn previously occupied by posterior spino-cerebellar fibers. In C2 and C1 both spino-cerebellar tracts intermingle and shift posteriorly to occupy the periphery anterior to the posterior horn. The cortico-spinal tract, therefore, loses its surface position and again extends medial to the spino-cerebellar tracts. The spino-thalamic again becomes more lateral and posterior. Plates of representative sections are presented.

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**Die Arbeitsbelastung der Hausfrau (Work Load of the Housewife).** H. Kraut; R. Schneiderhohn, and L. Wildemann. *Internat. Ztschr. angew. Physiol.* (In German) 16:275 (Sept.) 1956.

The authors present further studies of the caloric expenditure of housewives as studied by use of a Douglas sack and by a respiration meter which continuously sampled three per cent or six per cent of exhaled air by way of a small pump into a rubber collecting bag.

Figures for the amount of time devoted to each activity, the caloric demands of the activity, the daily caloric needs by type of day (wash day, cleaning day, Sunday), etc., are given. The households studied are in Dortmund, Germany. One consisted of two grown adults and a "day maid"; the other of three adults and two school-age children. Certain of the quantities cannot be related to contemporary American life, since, for example, the lack of refrigeration necessitated frequent trips to the market for at least one family, kitchen work occupied 20 to 25 per cent of the German women's time, and the type of washing machine used is not that in general use in America. The regular trip of the family to the community "laundromat" is perhaps more comparable. Nonetheless, careful and detailed study is reported including a number of charts, breaking down the information in many ways. It is concluded by the authors that the caloric needs of the housewife are between 2400 and 2800 K cal. per day, or 968,600 K cal. per year, with allowance for Sundays.

## book reviews

*The reviews here published have been prepared by competent authorities and do not necessarily represent the opinions of the American Congress of Physical Medicine and Rehabilitation and/or the American Academy of Physical Medicine and Rehabilitation.*

**PRACTICE OF MEDICINE.** Sixth edition. Edited by Jonathan C. Meakins, M.D. Cloth. Price, \$16.00. Pp. 1916, with 318 illustrations. The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, 1956.

This edition brings up to date one of the classics of medicine. Meakins' Textbook compares favorably with the other outstanding texts on the subject. It is succinctly written, well illustrated and typographically easy to read. The paper stock and the binding insure that it will be a durable book which will withstand much usage.

It is a collaborative effort which has brought together leaders in various fields of medicine to present their respective subjects authoritatively. The book is highly recommended for both medical students and graduate physicians; it deserves to be on the shelf of any practitioner of medicine. (Jerome S. Tobis, M.D.)

**THE REHABILITATION OF SPEECH.** Third edition. By Robert West; Merle Ansberry and Anna Carr. Cloth. Price, \$7.50. Pp. 688, with illustrations. Harper & Brothers, Publishers, 49 E. 33rd St., New York 16, 1957.

The definitive text in speech pathology has been revised and rewritten by the one man in the field best equipped to perform that task. The second edition, which has been the basic textbook in speech since publication, has been enlarged to include material on the hard of hearing which was not formerly available. There has been some preferred change in organization with less grouping under a specific pathology in the present volume, and more under a basic division of the aspects of speech which allows greater flexibility for student training. The entire contents have been brought up to date. The glossary as well has been happily enlarged and now includes many additional terms with precise, if occasionally cumbersome, definitions.

Book One may be read on several levels. It contains pure information as well as implications that emerge only from a second or third reading. It has the advantage over the former edition of developing many of these implications more fully. This remains the one

book which presents the basic concepts in the field of speech pathology. Book Two concerned with remedial procedures grows logically out of the rationale presented in the first section. The entire plan of *The Rehabilitation of Speech* seems to reveal that once the rationale is appreciated, the remedial procedure will suggest itself and the second section then becomes a guide to possible current technics.

Readers will admire the sanity and lack of partisan defense in the chapter on stuttering. The material on aphasia is particularly helpful. In the treatment of dyslalia one would question the inclusion of photographs presumably illustrating tongue placement. It is felt that insufficient information is gained to warrant such extensive use of pictures of a facial pathology which is at the least, distracting.

Much of the material concerned with secondary speech disorders seems fragmented and emphasizes the superficial. In discussing personality, much recent thinking and research has been ignored. However, considering the book's value as a reference source and teaching aid, these objections may be cavilling.

The total impression reveals the author to have a self-evident grasp of all aspects of speech pathology, and what is often more rare in a textbook, a profound respect for the English language. (Edward J. Lorenze, M.D.)

**THE ADAPTATION OF RECREATIONAL ACTIVITIES FOR MEN.** In the Rehabilitation of Lower Limb Injuries. By Veida Barclay. Cloth. Price, 18s.6d net. Pp. 154, with illustrations. G. Bell & Sons Ltd., Publishers, York House, Portugal St., London WC 2, 1956.

Veida Barclay is Superintendent of Rehabilitation at Patshull Rehabilitation Centre, Walverhampton, England. The author states in her preface that the book has been prepared "to show that recreational activities adapted for remedial purposes have a definite place in the scheme of rehabilitation after injury." She recognizes that recreational activities implement rather than supplant specific therapeutic exercises. Subjects covered in the manual include walking and running, vault-

ing, games, cycling, swimming, ballroom and folk dancing. The author explains that these activities produce excitement and enjoyment when properly selected and help the patient to forget his injury and regain confidence. Physical value from this program results from activities which produce specific movements and those designed to produce general movements of the whole body.

Safety of the patient is stressed throughout the book. The teacher must know the subject, maintain constant control over patients in class groups and assist patients to progress by establishing confidence in their own ability to perform. Patients are graded according to the level of recovery, age, and general athletic ability into early, intermediate, and advanced. Very adequate instructions, rules, methods and precautions are presented with each activity.

There are numerous photographs and diagrams throughout the book to explain technics. There is a short summary and an adequate bibliography. The activities described will require space and equipment not found in every institution which provides care for lower limb injuries. Recreational therapists of the obvious quality of the author are limited in number. Recreational activities conducted as described in the manual have some elements of pre-vocational testing value but should not be considered as a substitute for a more complete pre-vocational testing laboratory. This book describes in a competent manner recreational activities that have a place in the broad field of physical rehabilitation. (*Charles D. Shields, M.D.*)

**CLINICAL CARDIOPULMONARY PHYSIOLOGY.** Sponsored by The American College of Chest Physicians. Edited by *Burgess L. Gordon, M.D.* Cloth. Price, \$15.75. Pp. 759, with illustrations. Grune & Stratton, Inc., 381 Fourth Ave., New York 16, 1957.

This volume is considerably more comprehensive than its title implies. It is a fairly complete textbook of pulmonary and cardiac conditions with emphasis on physiological tests and measurements. Pathological anatomy is relatively de-emphasized, but practical therapy and management are extensively covered, even though many features of the therapy may be quite empiric. In general, the subject material, even though intricate, is presented in a manner easily understood by elementary students of the subject.

The book has the advantages and disadvantages of a multiple author volume. Much duplication is evident; several authors have emphasized special aspects and tests, with resultant incompleteness of their particular discussions. However, the total volume leaves almost no important topic undiscussed. The

reader would be wise to consult several references to a subject in the volume.

The increasing incidence of pulmonary invalidism in the population may be related to both age and industrial exposures. All physicians concerned with general groups of chronic disease patients need knowledge of this specialized area of medicine. This book can serve as an important introduction to the subject and also as a stimulus toward further reading in the more detailed and technical aspects. (*Robert C. Darling, M.D.*)

**AIDS TO OSTEOLOGY.** By *Nils L. Eckhoff, M.S.*, and *J. Joseph, M.D.* Sixth edition. Cloth. Price, \$3.25. Pp. 193, with illustrations. Bailliere, Tindall & Cox, 7-8 Henrietta St., London WC 2, England, 1957.

This handy pocket size book had its first edition in 1920. The sixth edition continues to stress the important facts about bones, primarily for the medical student. There are fewer minute details about individual bones and more detail about the relationship of the bones to their related structures.

The book is a handy, ready reference for knowledge of bones. Clinically it is not too valuable as a guide for applied anatomy when a physician might desire relative information pertaining to a specific problem. There is very much information packaged in a very small book, in small print. (*Robert W. Boyle, M.D.*)

**AN INTRODUCTION TO ELECTROCARDIOGRAPHY.** By *L. Schamroth, M.B.* Cloth. Price, \$2.50. Pp. 58, with illustrations. Charles C Thomas, Publisher, 301-327 E. Lawrence Ave., Springfield, Ill., 1957.

The main purpose of this book is to give the beginner in electrocardiography a working knowledge of this important diagnostic aid. Electrocardiography is the study of the electrical potential differences due to cardiac action, recorded from the body surfaces. It is an effort to record basic electrophysiologic phenomena and to obtain clinical interpretations from them. Its value is well established.

This book presents the basic principles of electrical activity of the heart in a simple easy to understand manner. The changes in the electrocardiogram due to myocardial injury, death and ischemia are then explained in logical fashion. Bundle branch block, ventricular hypertrophy, digitalis and potassium effects, and disorders of cardiac rhythm are discussed in turn. Dozens of sketches accompany each discussion and help simplify understanding of the material. Theoretical considerations are minimized and there is no



mention of vector cardiography. The book is an excellent elementary presentation which should serve as an effective stepping stone for beginners, students, or those who wish to review their elementary principles of electrocardiography. (*Arthur A. Rodriguez, M.D.*)

**EXERCISES EDUCATIFS EN ATHLETISME.** Vols. I and II. By *E. Vanden Eynde*. Paper. Price, 90 fr. Pp. 69, with 483 illustrations. Editions Nauwelaerts, 2, Place Cardinal Mercier, Louvain, Belgium, 1956.

This work consists of two pocket-sized paper-bound volumes, designed for the convenience of students and coaches in athletics at high school or college level in developing skill at the following sports: foot race, hurdles, high jump, pole vault, broad jump, shotput, javelin throw, and discus throw. The purpose is to improve the general condition of the student and to suggest the supplementary exercises that should facilitate performance in these particular sports. It is not a kinesiological analysis of muscular movements and does not undertake to dictate minutiae of style; neither is it a compendium of official rules, distances, weights, and methods of scoring.

The first volume outlines a remarkable repertory of exercises, and the second consists of a rich collection of photographs showing how they are to be carried out. The pictures are not well reproduced but adequate for their purpose. These two volumes contain many ideas that should be helpful to anyone interested in therapeutic exercise and physical reconditioning. They should be especially handy, because of their small size, for illustrating to a patient exactly what is desired in a given exercise. (*Frederic T. Jung, M.D.*)

**SURGERY IN WORLD WAR II:** Orthopedic Surgery in the Mediterranean Theater of Operations. Edited by *John Boyd Coates, Jr.*, Col., MC, U.S.A. Cloth. Price, \$4.00. Pp. 368, with illustrations. Office of the Surgeon General, Dept. of the Army, Washington, D. C., 1957.

The book is divided into chapters on administrative considerations; splinting in the combat zone; management of compound fractures; regional compound fractures; delayed internal fixation of compound fractures; external skeletal fixation of fractures; wounds of joints; amputations, and non-combat orthopedic lesions.

This is an excellently written work and well represents the series of historical volumes published by the Surgeon General's Office on

World War II. It is regrettable that the Reserve program between 1918 and 1941 did not even teach the lessons learned in World War I. It is to be hoped that in any future war the lessons of World War II and of the Korean conflict might at least be learned in the existing medical reserve program. Unfortunately the medical department like the rest of the Army is always one war behind. As brought out by Dr. Hampton the main blunders consisted of inadequate debridement; closing fresh battle wounds; inadequate methods of fixation for transportation purposes, and confusion of clostridial myositis with non-clostridial infections.

The photographs are very well chosen. There are large sections of the work of primary interest only to the orthopedist; but the work is highly recommended for interested persons. (*Sedgwick Mead, M.D.*)

**FOOT TROUBLES.** By *T. T. Stamm*, F.R.C.S. Cloth. Price, \$4.75. Pp. 122, with illustrations. Philosophical Library, Inc., 15 E. 40th St., New York 16, 1957.

Here is a book full of valuable information on a much neglected subject. The increasing mechanization of modern life curiously has led not to a decrease but to a considerable increase in foot troubles. In addition, more people are living longer and more actively thus increasing the number of foot sufferers. Feet should not be neglected when minor manifestations appear; otherwise severe crippling conditions will develop at a later date.

Most foot trouble is caused by the development of bad habits by the postural centers. Treatment should be concentrated on correction of these habits and not on special exercises for developing strength of the muscles of the foot. When there are good postural habits there will be no pain or fatigue. Pain of mechanical origin is almost always due to either excessive pressure or excessive strain of some structure.

The ideal foot is one that is supple and quite flat on standing at rest, but which becomes arched by strong muscles when being used as a lever for walking, running and jumping. The average foot falls short of this ideal.

The author then describes the causes and treatment of flat feet, foot strain, hallux valgus, hallux rigidus and other foot troubles. He also includes chapters on care of children's feet, footwear and foot exercise, all showing great thought and experience. This is recommended reading for all who treat "foot trouble." (*Odon F. von Werssowetz, M.D.*)

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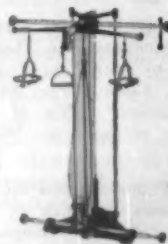


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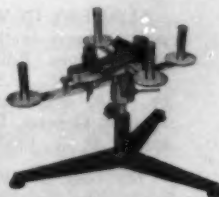
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Why?

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Weissenberg, Eugene H., Clinical Professor, Physical Medicine and Rehabilitation, University of Puerto Rico; Director, Physical Medicine and Rehabilitation, School of PT and OT, State Insurance Fund, Professional Bldg., Santurce

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## Neuromuscular Diseases of Children

The Cook County Graduate School of Medicine announces a two-week intensive course in Neuromuscular Diseases of Children with special emphasis on cerebral palsy, to be given by Doctor Meyer A. Perlstein for the period of July 7 to 18, 1958. This is an intensive didactic and clinical course designed for physiatrists, pediatricians, orthopedists, neurologists, and psychiatrists interested in the care and treatment of children with neuromuscular handicaps. Emphasis will be placed on the practical clinical aspects of treatment and rehabilitation procedures. The course will include trips to demonstration clinics and treatment centers. The fee for the course, which is \$250, will include the cost of transportation and accommodations during the field trips. Registration in the course is limited. For further information, write to John W. Neal, Registrar, Cook County Graduate School of Medicine, 707 S. Wood St., Chicago, Ill.

## Army issues 35-page want ad for 200 scientists

The U. S. Army wants 200 scientists to become regular army officers.

In a very attractive 35-page "want-ad," the Army has introduced its Project 200, described as a "unique program" for scientists and other advanced specialists offering "not only unlimited professional horizons but also outstanding personal rewards."

The Department of Defense campaign, said to be a "high-priority" project, is a recruitment drive for 200 outstanding civilian specialists in 20 critical fields.

"Since the work of men in Project 200 is of the most advanced nature," the Army says, "the qualifications for the project are naturally high."

## Backaches come from unsolved problems

Backaches are mostly caused by failing to come to terms with everyday emotional problems, Dr. T. H. Holmes, University of Washington, Seattle, told the Academy of Psychosomatic Medicine meeting in Chicago.

Controlled tests have shown that too much muscle function and electrical activity usually accompany low back pain, and the pain is always set off after the patient's security has been threatened.

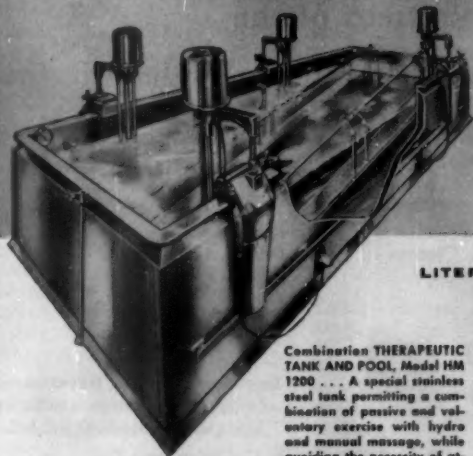
Backache is a reaction that sets in when a person tries to solve a "life situation" and does not succeed, the psychiatrist reported.

Chief causes of these insecurity feelings include conflict, anxiety, frustration, humiliation and guilt. The pain they cause may show up in the back, neck or extremities when these interpersonal and social reactions are not properly dealt with.

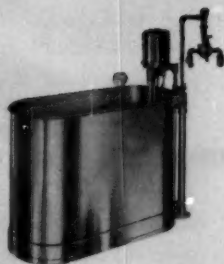
Available evidence points to the fact that the element potassium is the pain factor in backache. When intense muscle activity continues there is a gradual accumulation of the chemical in the tissues. After the concentration has become high enough, the pain threshold is exceeded and the result is a common backache.

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*Announcing . . .*

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# AMERICAN CONGRESS OF PHYSICAL MEDICINE AND REHABILITATION

To stimulate interest in the field of physical medicine and rehabilitation, the American Congress of Physical Medicine and Rehabilitation will award annually, a prize for an essay on any subject relating to physical medicine and rehabilitation. The contest, while open to anyone, is primarily directed to interns, residents, graduate students in the pre-clinical sciences and graduate students in physical medicine and rehabilitation. The Essay Award Committee suggests that members of the American Congress and American Academy of Physical Medicine and Rehabilitation bring this announcement to the attention of interested persons. The following rules and regulations apply to the contest:

1. Any subject of interest or pertaining to the field of physical medicine and rehabilitation may be submitted.
2. Manuscripts **must be** in the office of the American Congress of Physical Medicine and Rehabilitation, 30 N. Michigan Ave., Chicago 2, not later than June 2, 1958.
3. Contributions will be accepted from interns, residents, graduate students in the pre-clinical sciences, and graduate students in physical medicine and rehabilitation.
4. The essay must not have been published previously.
5. The American Congress of Physical Medicine and Rehabilitation shall have the exclusive right to publish the winning essay in its official journal, the ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION.
6. Manuscripts must not exceed 3000 words (exclusive of headings, references, legends for cuts, tables, etc.), and the number of words should be stated on the title page. An original and one carbon copy of the manuscript must be submitted.
7. The winner shall receive a cash award of \$200.
8. The winner shall be determined by the Essay Award Committee composed of four members of the American Congress of Physical Medicine and Rehabilitation.
9. All manuscripts will be returned as soon as possible after the name of the winner is announced.
10. The American Congress of Physical Medicine and Rehabilitation reserves the right to make no award if, in the judgment of the Essay Award Committee, no contribution is acceptable. Announcement of the winner will be made at the annual meeting.

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3. *Contributions will be accepted from medical students only.*
4. The American Congress of Physical Medicine and Rehabilitation shall have the exclusive right to publish the winning essay in its official journal, the *Archives of Physical Medicine and Rehabilitation*.
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7. The winner shall receive a cash award of \$100.
8. The winner shall be determined by the Essay Award Committee composed of four members of the American Congress of Physical Medicine and Rehabilitation.
9. All manuscripts will be returned as soon as possible after the name of the winner is announced. The winning manuscript becomes the exclusive property of the American Congress of Physical Medicine and Rehabilitation.
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## *I Gotta Sell Some Goods This Month!*

So here goes: First, by giving away some merchandise for free. Would you like to own a \$645.00 Birtcher Megason V Ultrasonic Unit, complete with its patented 5-Way Adjustable Transducer? If so, simply write your name and address on a piece of paper and get it to me by April 30.

I'll simply borrow a hat (I don't own one) and get a blind friend at a nearby bistro to draw someone's name (maybe yours) from the hat and to that name and address, I'll ship a Megason V no charge. It's just as simple as that — no bottle tops, coupons, no 25 word statements, puzzles or gimmicks of any kind and the deal is on the level.

Want a \$94.00 Spot Quartz Lamp? Write your name and address on a second piece of paper and mail it, too. Same deal — I'll get another hat (have some two-headed pals). We know quite a few who frequently get blind so we can have another drawing. Someone (maybe you) will get a Birtcher Spot Quartz free! No strings attached.

**Rules:** (such as they are) Participants must be physicians, physical therapists, or nurses. My pointed headed relatives, employees and immediate companions can't play. No one has to buy anything, I'd just be happy if they did. Please address all mail on this deal to the

Blind Editor  
P. O. Box 32187  
Los Angeles 32, California

Heck of a way to run a railroad, ain't it?

Cordially yours,

*Cecil Birtcher*

C. J. BIRTCHER, President  
The Birtcher Corporation



**ALL MADE BY BIRTCHER**

**UNDERWRITERS' LABORATORIES  
TESTED FOR YOUR SAFETY**